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# METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY

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*EDITORIAL OFFICE: 2d and B Streets S.E., Washington, D. C. P.O. ADDRESS: Box 1736, Washington 13, D. C. Telephone: REpublic 6278. ADMINISTRATIVE OFFICE: American Meteorological Society, Office of Executive Secretary, 5 Joy Street, Boston 8, Mass.

* Address all business communications, orders and inquiries to the Executive Secretary, Mr. Kenneth C. Spengler, 5 Joy Street, Boston 8, Mass. Exchanges and reprints may be sent direct to P. O. Box 1736, Washington 13, D. C.

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B. Bibliographic references to other items of interest to the profession.

C. Cumulative, annotated bibliographies on subjects of immediate and special interest to meteorologists.

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# METEOROLOGICAL ABSTRACTS AND BIBLIOGRAPHY

MALCOLM RIGBY, Editor

Vol. 1 MARCH 1950 No. 3

**SPECIAL FEATURE IN THIS ISSUE**

A Selective Annotated Bibliography on Cloud Physics and Artificial Precipitation

(*For complete table of contents see back cover*)

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# FOREWORD

Because this issue contains a rather extensive and fully anotated bibliography on Artificial Precipitation and Cloud Physics, (a very important field of research both in respect to the theoretical and the practical development of meteorology) the space devoted to Current Abstracts has been limited, and the review of periodicals containing meteorological bibliographies has been postponed until a later issue.

The special cumulative annotated bibliographies published in this journal thus far are:

(1) **Atmospheric Pollution** (240 items) Vol. 1, No. 1, Jan. 1950
(2) **Aerobiology** (145 items) Vol. 1, No. 2, Feb. 1950
(3) **Artificial Precipitation** (202 items) Vol. 1, No. 3, March 1950

Future issues will contain bibliographies on:

(4) **Hail and Hail Damage,** (5) **Tornadoes,** (6) **Icing.**

In addition the first issue (Vol. 1, No. 1) contained a **Review of 30 Current Meteorological Periodicals,** and the second issue **A Review of 15 Meteorological Periodicals which have lapsed.**

As far as possible, all articles on subjects related to meteorology, appearing in the following journals, and dated January 1950 or thereafter, will be analyzed and included in either Part I, Part II or Part III of this publication. There will be a time-lag of from two to four months between the date of receipt and the date of publication of an abstract of any current article. Past material (1949 or earlier) will be used to fill in Parts I, II, and III as space permits.

# LIST OF PERIODICALS

**Note:** In this list the preferred form of title for entry is given in bold face type. If the title is distinctive, the name and headquarters of the issuing society or organization follows the title. If the title is not distinctive the issuing organization precedes and is part of the title.

## PERIODICALS IN WHICH METEOROLOGICAL ARTICLES REGULARLY APPEAR

**Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofiz.,** [Moscow].
**American Geophysical Union, Transactions,** National Research Council, Washington.
★**American Meteorological Society, Bulletin,** [Boston].
★**Annalen der Meteorologie,** Meteorologisches Amt für Nordwestdeutschland, Hamburg, [British Zone, Germany].
**Annali di Geofisica,** Istituto Nazionale di Geofisica, [Rome].
**Ciel et Terre,** Société Belge d'Astronomie, de Météorologie et de Physique du Globe. Uccle-Bruxelles.
**Geofisica Pura e Applicata,** Istituto Geofisica Italiano, [Milan].
**Geophysical Magazine,** [Central Meteorological Observatory, Toyko].
**Hemel en Dampkring,** Nederlandse Vereniging voor Weer- en Sterrenkunde, [The Hague].
★**Időjárás,** Az Országos Meteorológiai és Földmágnességi Intézet, [Budapest].
**Journal of Geophysical Research** (formerly Terrestrial Magnetism and Atmospheric Electricity), [Washington].
★**Journal of Meteorology,** American Meteorological Society, [Boston].
★**Journal Scientifique de la Météorologie,** Société Météorologique de France, [Paris].
★**The Marine Observer,** Air Ministry, Meteorological Office, London.
★**The Meteorological Magazine,** Air Ministry, Meteorological Office, London.
★**Meteorological Society of Japan, Journal,** Second Series, Kisho Shushi, [Tokyo].
★**Meteorologické Zprávy,** Státní Meteorologický ústav v Praze, [Prague].
★**La Météorologie,** Société Météorologique de France, [Paris].
★**Meteorologische Rundschau,** Bad-Kissingen, [U. S. Zone, Germany].
★**Monthly Weather Review,** U. S. Weather Bureau, Washington, D. C.
★**Nimbus,** Sociedad Meteorológica de Bolivia, [La Paz].
**Polarforschung,** Archiv für Polarforschung in Kiel, [Kiel, British Zone, Germany].
★**Revista Meteorológica,** Junta Nacional de Meteorología, Montevideo.
★**Rivista di Meteorologia Aeronautica,** Associazione Culturale Aeronautica, [Rome].
★**Royal Meteorological Society, Quarterly Journal,** [London].
The **Royal Society of London, Proceedings, Series A, Mathematical and Physical Sciences,** [London].
★**Tellus,** Svenska Geofysiska Föreningen, Stockholm.
**Vsesoiuznoe Geograficheskoe Obshchestvo, SSSR, Izvestiia,** [Moscow-Leningrad].
★**Weather,** Royal Meteorological Society, [London].
★**Weatherwise,** Amateur Weathermen of America, Philadelphia.
★**Wetter und Klima,** Deutscher Meteorologischer Dienst im Französischen Besatzungsgebiet, Seelbach b. Lahr/Baden, [French Zone, Germany].
★**Wetter und Leben,** Österreichische Gesellschaft für Meteorologie, [Vienna].
★**Zeitschrift für Meteorologie,** Meteorologisches Observatorium, Potsdam, [U. S. S. R. Zone, Germany].

★ Indicates those periodicals which are primarily meteorological.

# EXPLANATIONS

**Location of material:** While it is physically impossible to give for each entry the name of every library where that item might be obtained, it is possible, by using standard library symbols, to give the reader some idea of where he might obtain such material. So in most instances a symbol taken from the Union List of Serials (Gregory), or the Union Catalogue of the Library of Congress will be given just before the text of each abstract. In some cases where no symbol has been assigned to a library, one will be invented by using the general principle of the Union Catalogue list. As a rule the library indicated will be in the District of Columbia, with an occasional reference to one in New York or Boston. It will be noted that D stands for District of Columbia, M for Massachusetts and N for New York. Thus **DWB** stands for the U. S. Weather Bureau Library in Washington, D. C. and **MH–BH** for the Blue Hill branch of the Harvard Library in Boston, Mass. In the latter case since the Blue Hill Observatory contains not only the Harvard Observatory Library but that of the American Meteorological Society, the same symbol (**MH–BH**) will stand for either or both libraries.

**Library symbols:** The following abbreviations have been used for Libraries in which the specific material thus indicated in this issue is located:

| | |
|---|---|
| **DA:** | U. S. Department of Agriculture Library, Washington, D. C. |
| **DAMS:** | Material in hands of American Meteorological Society Abstracts, P.O. Box 1736, Washington 13, D. C. |
| **DAWS:** | Air Weather Service, Technical Information Files, Andrews Air Base, Washington 25, D. C. |
| **DBS:** | U. S. Bureau of Standards Library, Washington, D. C. |
| **DGS:** | U. S. Geological Survey Library, Washington, D. C. |
| **DLC:** | Library of Congress, Washington, D. C. |
| **DM:** | U. S. Bureau of Mines Library, Washington, D. C. |
| **DPL:** | U. S. Department of Defense, (Pentagon) Library, Washington, D. C. |
| **DSG:** | U. S. Army Medical Library, Washington, D. C. |
| **DWB:** | U. S. Weather Bureau Library, Washington, D. C. |
| **MH:** | Harvard University Library, Cambribge, Mass. |
| **MH–BH:** | Harvard University, Blue Hill Observatory (and American Meteorological Society) Library, Milton, Mass. |
| **NNM:** | American Museum of Natural History Library, New York. |
| **NSGE:** | General Electric Research Library, Schenectady, N. Y. |

**Geographical (place) names** are in the form generally used internationally, rather than in the form used locally. For instance Vienna is used instead of Wien, Florence for Firenza, Moscow for Moskva and Germany for Deutschland, etc.

**Titles of articles or monographs** are in the language of the original article unless otherwise stated. Slavic (Cyrillic) titles are transliterated according to the Library of Congress transliteration scheme into the Roman Alphabet.

Entries for **titles of periodicals** are given in the form used on the title page of the periodical providing the title is distinctive (Monthly Weather Review, Meteorologiské Zprávy, and Revista Meteorológica). If the journal is the official organ of a society or institution and the title is not distinctive as is the case with Transactions, Bulletins, Proceedings, Comptes Rendus, Trudy, Izvestiia, Sitzungsberichte, Verhandelingen, Miscellanées, etc., the preferred name of the organization is given first as part of the title (American Geophysical Union, Transactions; Royal Society of London, Proceedings).

**Abbreviations and other symbols:**

*Titles of periodicals* are not abbreviated as a rule. Other abbreviations will be used sparingly and only when the abbreviation is obvious.

The months of the year from March through July are not abbreviated. Other months are abbreviated as Jan., Feb., Aug., Sept., Oct., Nov., and Dec., respectively.

The word or abbreviation for Volume, (Tom, Band, Jahrgang, Año, etc.) and for Number (Heft, Fascicule, Vypusk) and page or pages is omitted from most entries. Thus an entry will read as follows:

Meteorologische Rundschau 2(5/6):146–151, May/June 1949.

This indicates that the article was in the Meteorologische Rundschau, Jahrgang 2 (Vol. 2) Heft 5/6 (No. 5 and 6), pages 146–151, Mai/Juni 1949.

The symbol * before an entry indicates a good data source.

The symbol † before an entry indicates a good bibliography source.

The symbol § indicates a synoptic case history study accompanied by charts.

# PART I. ABSTRACTS OF CURRENT METEOROLOGICAL MATERIAL

## GENERAL METEOROLOGY

3–1 551.5(09)(04)

Philipps, H., **Historische Betrachtungen zur Meteorologie.** [Historical aspects of meteorology.] Zeitschrift für Meteorologie, 3(8–9):230–235, Aug.–Sept. **1949. DWB**—A philosophical talk about the history of meteorology and problems of weather forecasting. *Subject Headings:* **Meteorology, Weather forecasting, History.**

3–2 551.5:41

Becker, Richard, **Wetter-Eigennamen.** [Weather names.] Wetter und Klima, (1–2):51–55, Jan.–Feb. **1949. DWB**—An alphabetical glossary of 37 weather names with some explanations. *Subject Heading:* **Glossaries.**

3–3 551.5:41

†Schindler, Gerhard, **Über den Mangel gewisser meteorologischer Begriffsdefinitionen.** On the lack of exact definitions of meteorological conceptions.] Zeitschrift für Meteorologie, (5–6):169–172, May–June **1949.** 50 refs. **DWB**—Describes difficulties in making a meteorological dictionary because of words with changed meanings, different usages in different countries, ambiguities and differences of definition of the same term (e.g., raindays). *Subject Heading:* **Glossaries.**

3–4 551.5:61(09)

Flohn, Hermann, **Zur Geschichte der Meteoropathologie der Grippe.** [On the history of the meteoropathology of influenza.] Meteorologische Rundschau, 1(11–12):354–355, May–June **1948.** 12 refs. **DWB**—*Subject Headings:* **Medical meteorology, History.**

3–5 551.5:61(09)

Flohn, Hermann, **Hippokrates und die heutige Meteorologie.** [Hippocrates and the meteorology of today.] Meteorologische Rundschau, 1(11–12):355–356, May–June **1948.** refs. **DWB**—*Subject Headings:* **Medical meteorology, History, Hippocrates.**

3–6 551.5:621.396

Booker, H. G., **Some problems in radio meteorology.** Royal Meteorological Society, Quarterly Journal, 74(321–322):277–315, July–Oct. **1948.** 19 figs., 2 tables, 35 formulas, 21 refs., 2 append. Summary p. 277–278. **DWB**—The author defines radio meteorology as including "all phenomena of radio propagation that are related to the weather," and gives examples such as: (1) atmospherics, (2) detection and location of precipitation by radar, (3) attenuation of ultra-short waves by rain or cloud, and (4) mirage or refraction phenomena in the lower levels. He excludes those reflection or refraction phenomena produced by the ionosphere or high level inversions, and confines his paper to an intensive theoretical and graphical treatment of refraction, super-refraction, and eddy diffusion produced by varying lapse rates of temperature and humidity in the lower atmosphere. Many profiles and schematic diagrams show critical limits which must be forecast by the meteorologist or analyst. Theoretical results checked against empirical, using data obtained over Massachusetts Bay by Montgomery. Discrepancies analyzed suggest further investigation of effect of sea breeze, trade wind, inversions, coastal fronts, and statistical variation of refractive index due to turbulence, scattering etc. Extensive tables for Radio Refractive Index of the atmosphere at temperatures from −19° to +120°F., and the Incomplete Gamma Function as an atmospheric profile, are appended. *Subject Heading:* **Radio meteorology.**—*M.R.*

3–7 551.5:629.13(469.9

†*§Great Britain Meteorological Office, **Aviation meteorology of the Azores.** London, H. M Stationery Office, **1949.** 89 p., 33 figs., photo folding plate, 10 tables, 12 append., bibliog. c 51 items. ([Great Britain] Meteorological Office. Meteorological Reports, No. 2.) At hea of title: M.O. 496b. **DWB**—Part I deals with frontal and air-mass situations with 14 analyze synoptic charts representing different types and air-mass tephigrams. Flying conditions give for different airfields, (Santa Cruz das Flores, Horta, Angra do Heroismo, Ponta Delgada an Lagens). Part II (Climatology) describes distribution and variations of climatic element Appendices give monthly climatic summaries for five stations and detailed summaries c visibility, cloud and wind. *Subject Headings:* **Aeronautical meteorology, Climatology, Azores**

3–8 551.5:725.3

*†Durst, C. S., **Meteorology of airfields.** London, H. M. Stationery Office, **1949.** 87 p 30 figs., 42 tables, 17 refs., 4 append. ([Great Britain] Meteorological Office.) At head c title: M. O. 507. **DWB**—Physical factors influencing frequency of occurrence of visibility cloud, precipitation, wind, pressure and temperature as affecting airport sites. Data an conclusions useful in planning airports and alternates. Emphasis on fog formation. "Flyin Fitness" figures compounded for visibility, ceiling, etc. Suggests application elsewhere. Dat for airfields in all parts of the world and charts for world, of mean and extreme values c various elements and probabilities of their occurrence are given. A very practical and thoroug treatise. *Subject Headings:* **Aeronautical meteorology, Airports.**—*M.R.*

3–9 551.5:629.13(02

§Viaut, André, **La météorologie du navigant.** [Meteorology of (aerial) navigation.] Paris, Éditions Blondel la Rougery, **1949.** 257 p., 139 figs., 25 plates, 3 fold-in charts. **DLC**— The most up-to-date and detailed textbook on meteorology for pilots, prepared by one who thoroughly and actively acquainted with all phases of meteorology, forecasting and interna tional networks. Besides the usual discussion of the structure and physics of the atmosphere pressure, temperature, humidity, air-mass fronts, clouds, fog, haze, wind, turbulence an stability, aerological instrumentation, and map analysis, the book contains a great amount c material not usually found in similar texts. For instance: ten pages are devoted to a discussio of various sorts of aircraft icing, with a chart of the mean height of the zero isotherm ove Europe, and many schematic (adiabatic and other) diagrams to indicate where the icin danger is most likely to be found. A chapter on meteorological networks is useful for tran ocean pilots, and includes a chart showing the location of the Atlantic weather ships. Dange ous phenomena (hurricanes, tornadoes, waterspouts, sandstorms, hail and thunderstorms static and ice are discussed in another chapter. The next to the last chapter takes up, in systematic manner, forecasting and upper air charts of various kinds; while the final chapter devoted to organizations, methods, rules, reports and services for protecting aviation again weather hazards. The amount of original material (such as many unusual cloud photograp made by M. Viaut), the material extracted from ICAO, IMO and ONM documents and report and specific studies accompanied by all of the auxiliary weather charts, flight analysis and cro sections and even elaborate fold-in charts of weather over the North Atlantic, makes the te extremely practical for anyone interested in "global" air navigation (who can read French c interpret charts). *Subject Headings:* **Aeronautical meteorology, Textbooks.**—*M.R.*

## METEOROLOGICAL OBSERVATIONS AND INSTRUMENTS

### OBSERVATIONS

3–10 551.501(09)(26

King, J. A., assisted by Boogard, H. M. E. van den, **Marion Island.** Weather, 5(1):26–3 Jan. **1950.** fig., 4 photos. **DWB**—An interesting article describing the history and occupatio of Marion Island, and the physiographic features at this meteorological station (midwa between Cape of Good Hope and the Antarctic Continent). A map shows all the weath stations in the region and clear photographs give some idea of conditions there. Only a bri paragraph is devoted to meteorological conditions. *Subject Headings:* **Observatories, Histor Marion Island, Antarctic.**—*M.R.*

3–11 551.501:551.524.35

Schindler, Gerhard, **Vorschlag zur Darstellung der zeitlichen Temperaturabweichungen.** [Suggestion for representing temporary deviations of temperature.] Wetter und Klima, 2(1–2):43–46, Jan.–Feb. **1949.** 3 refs. **DWB**—Proposes to give each day a number, + or −, equal to number of days later or earlier (in spring) that long period daily normal (smoothed by sine curves if desired) reaches mean temperature for that day. Can be summed for month or season; useful in phenology and bioclimatology. *Subject Headings:* **Methods of computation, Temperature variations.**—*C.E.P.B.*

3–12 551.501:37

Schmauss, A., **Zur Psychologie der meteorologischen Beobachter.** [The psychology of the meteorological observer.] Wetter und Klima, 2(3–4):65–69, March–April **1949,** 2 refs. **DWB**—Some observers, e.g., teachers, cannot observe phenomena equally attentively at all times. Appeals for teaching of weather study in schools and a class weather log. *Subject Headings:* **Teaching of meteorology, Observers.**

3–13 551.501.3

Whiten, A. J., **A concise method for recording synoptic data.** Meteorological Magazine, [London], 79(931):11–12, Jan. **1950.** illus. **DWB**—A letter and figure code represents: type of circulation; type, position, distance, speed and direction of movement of nearest front and its intensity. *Subject Heading:* **Synoptic codes.**

3–14 551.501.9

Fedorov, Evgenii Konstantinovich, **Meteorologicheskie pribory i nabliudeniia.** [Meteorological equipment and observations.] Trudy dreifuiushchei stantsii "Severnyi Polius," Nauchnye otchety i rezul'taty nabliudenii dreifuiushchei Ekspeditsii Glavsevmorputi, 1937–1938gg. Vol. 2, Izdat. Glavsevmorputi, **1941–1945, DLC**—Detailed description and drawings, photos, etc., of drifting station on ice. Tables give instrumental errors. Describes construction of station, location of instruments and other problems. *Subject Headings:* **Observatories, Expeditions, Arctic.**—*M.R.*

3–15 551.501.9(43)

Pelzl, E., **Die neue Wirkungsstätte des Potsdamer Wetterdienstes,** [The new office of the Potsdam Weather Service.] Zeitschrift für Meteorologie, 3(8–9):229–230, Aug.–Sept. **1949,** fig. **DWB**—*Subject Headings:* **Weather services, Potsdam, Germany.**

## INSTRUMENTS

3–16 551.501.1:551.508.23

Canada, Dept. of Transport, Meteorological Div. (Toronto) **Sunshine recorder.** Jan. 3, **1949.** 7 p., tables. **DWB**—Description of Campbell-Stokes sunshine recorder used in Canada. Its adjustment, care, compilation of records. *Subject Headings:* **Instructions for observers, Sunshine recorders.**

3–17 551.508.11:551.511:551.557

Durst, C. S., and Gilbert, G. H., **Constant height balloons—calculation of geostrophic departures.** Royal Meteorological Society, Quarterly Journal, 76(327):75–86, Jan. **1950.** illus., 6 tables, 7 refs., 5 equations, 2 append. Summary p. 75. Discussion p. 87–88. **DWB**—Accelerations observed during flight of seven constant height balloons at 400–500 mb. level at one half hourly intervals over 2–4½ hour flights gave values of departures from geostrophic motion close to those deduced independently from 500 mb. contour charts and observed winds. Variations are greater than would be expected from errors in wind determination, owing to eddies in wind at level of flight. *Subject Headings:* **Balloons, Upper air winds.**

3–18 551.508.45

Gelbke, W., **Ein neuartiges Hypsometer.** [A new type of hypsometer.] Zeitschrift für Meteorologie, 3(5–6):162–165, May–June **1949.** 5 figs. **DWB**—Describes a metal hypsome-

ter, electrically heated, for use on ships. Steam circulates round a thermometer cased in a hollow cylinder, protecting it from cooling by winds up to force four at 68°F. Thermometer graduated in mb. to 1/10, scale illuminated and read by movable lens. Made by I. and A. Busch, Freiburg. *Subject Heading:* **Hypsometers.**—*C.E.P.B.*

3–19 551.508.5

Gelbke, W., **Wege zur Konstruktion eines kältefesten Windmessers.** [Method of construction of a wind recorder unaffected by frost.] Zeitschrift für Meteorologie, 3(8–9): 260–266, Aug.–Sept. **1949.** 6 figs., 13 refs. **DWB**—Some methods of preventing loss of record owing to frost are discussed. One investigated consists of a pendulum with a spherical pressure body held above a Cardan (universal) joint by a counterweight. The inclination of the pendulum shows wind direction and force. Short period oscillations are damped out by mercury and instrument is dead-beat. Recording may be by a resistance method resolving wind into north and east components; photoelectric (suitable for filming squalls) or inductive. It worked satisfactorily for one winter. *Subject Heading:* **Wind recorders.**—*C.E.P.B.*

3–20 551.508.58

Mrose, Helmut, **Zur Praxis der Wolkenzugmessung.** [Practical measurement of cloud direction.] Zeitschrift für Meteorologie, 3(3):91–92, March **1949. DWB**—In observing with a mirror nephoscope, head should be rested on forearm or fist and height of eye measured. Describes how to make a mirror nephoscope. *Subject Heading:* **Nephoscopes.**—*C.E.P.B.*

3–21 551.508.7:551.574.42

**Meter measures icing rate.** Air Force, 32(2):39, Feb. **1949. DLC**—Instrument developed by General Mills and tested at Wright Field, determines quantity and rapidity of accumulation of ice on surfaces. *Subject Heading:* **Icing meters.**

3–22 551.508.71

Brauckhoff, H., **Der Einfluss von Kochsalzstaub auf die Hygrometeranzeige.** [The influence of kitchen salt dust on hygrometer readings.] Zeitschrift für Meteorologie, 3(3):90–91, March **1949.** table. **DWB**—A hair hygrometer over a saturated salt solution at 75% relative humidity became coated with salt and when R.H. fell, it read persistently too high. *Subject Heading:* **Hygrometers.**—*C.E.P.B.*

3–23 551.508.71

Brauckhoff, H., **Der Einfluss der Temperatur auf die Anzeige von Haarhygrometern.** [The influence of temperature on the readings of hair hygrometers.] Zeitschrift für Meteorologie, 3(5–6):172–174, May–June **1949.** table. **DWB**—The temperature coefficient of expansion of hair between 20° and 65°C. at 100% R.H. is constant at $19 \times 10^{-6}$, at 0% at $22 \times 10^{-6}$. At medium humidities it is much smaller. At temperatures of 80–190°C. there is an increasing irreversible molecular shortening. *Subject Heading:* **Hygrometers.**—*C.E.P.B.*

3–24 551.508.71:551.571

Brauckhoff, H., **Die Messung der Luftfeuchtigkeit mittels Haarhygrometers.** [Measuring atmospheric humidity with the hair hygrometer.] Wetter und Klima, 2(1–2):33–37, Jan.–Feb. **1949.** 2 tables, 2 refs. **DWB**—In humidities below saturation hair hygrometers develop an increasing + error, which is reversed by regeneration in saturated air. This is not significant in the open except in very dry weather with night maxima 80% or less, when frequent regeneration is necessary. Best setting is 2–3% low with humidity 90–50% having fallen from 95% 1–2 hours before. *Subject Headings:* **Hygrometers, Humidity.**—*C.E.P.B.*

3–25 551.508.822:621.396

Meurers, Joseph, **Zur Höhenmessgenauigkeit der Radiosonde.** [Accuracy of height measurements by the radiosonde.] Zeitschrift für Meteorologie, 3(5–6):176–178, May–June **1949.** 3 figs. **DWB**—The RfW radiosonde gave + errors (heights too great) by an amount increasing upwards to an average of 300 m. at 14 km. The Graw radiosonde up to 7 km. gave more − than + errors but from 8 km. upwards the probability of a + error increased; errors often exceeded +200 m. above 11 km. *Subject Heading:* **Radiosondes.**—*C.E.P.B.*

3–26 551.508.94

Kilinski, Erich von, **Ein neues Verfahren zur Registrierung der luftelektrischen Leitfähigkeit.** [A new apparatus for recording the electric conductivity of air.] Zeitschrift für Meteorologie, 3(5–6):174–175, May–June 1949. fig. **DWB**—Apparatus includes a condenser in the capacity of which rapid changes are introduced by a rotor. The alternating current is amplified and passed to a recorder. *Subject Heading:* **Atmospheric electricity instruments.**—*C.E.P.B.*

## SYNOPTIC ANALYSIS AND FORECASTING

3–27 551.509.3:551.509.5

Vederman, Joseph, **The Weather Bureau-Air Force-Navy Analysis Center.** American Meteorological Society, Bulletin, 30(10):335–341, Dec. 1949. 7 figs., 2 refs. **DWB**—A systematic account of the functions and operation of the "Master Analysis Center" in Washington, D. C. under the direction of J. R. Fulks. In an attempt to avoid duplication of effort between the various services and the forecast centers of the services themselves, surface and upper air data are collected from the entire hemisphere and plotted and analyzed by a staff of 126 persons, of whom over 40 are professional meteorologists or aerologists of the Air Force, Navy and Weather Bureau. This article describes in detail the staff, the method of reception, plotting and analyzing the data, the types of charts drawn, the preparation of prognostic charts, and finally the method of checking and disseminating the "canned" analyses to over 100 Air Force and 50 Navy Stations in addition to Weather Bureau Forecast Centers. Interesting pictures of activities, and the inevitable "organizational flow chart" accompany the description. *Subject Headings:* **Analysis centers, Weather map analysis, Washington, D. C.**—*M.R.*

3–28 551.509.1

Gold, Ernest, **Frequency distribution of wind speed in synoptic reports.** Meteorological Magazine, [London], 79(931):22–23, Jan. 1950. 2 tables. **DWB**—Anemometer speeds ending in 9 or 1 tend to be thrown to nearest 0, those in 4 or 6 to 5. Noninstrumental estimates are mostly equivalents of whole Beaufort forces. *Subject Heading:* **Synoptic codes.**

3–29 551.509.3:551.513(6)

§Forsdyke, A. G., **Weather forecasting in tropical regions.** London, H. M. Stationery Office, 1949. 82 p., 12 figs., 29 refs., 19 equations. ([Great Britain] Meteorological Office. Geophysical Memoirs, No. 82.) At head of title: M. O. 499b. **DWB**—After mentioning types of forecast and technique required in East Africa, author discusses equations of motion in low latitudes, departures from geostrophic and other pressure wind relations, effect of friction and flow of air across isobars. Convergence and divergence, both frontal and regional, are of basic importance, and their calculation is illustrated by seven analytic charts. Part III deals briefly with upper air temperature and humidity in relation to instability and convection. Part IV considers origin and classification of fronts and pressure waves, movements of Intertropical Convergence Zone and penetration of polar front into tropics. Much recent literature is summarized and outstanding problems listed. *Subject Headings:* **Methods of forecasting, Atmospheric circulation, East Africa.**

3–30 551.509.31

Panofsky, H. A., **Objective weather-map analysis.** Journal of Meteorology, 6(6):386–392, Dec. 1949. 13 figs., 2 tables, 2 refs., 3 equations. Abstract p. 386. **DWB**—A comparison of objective and subjective methods of analyzing wind and pressure fields with an example from a situation in the eastern United States on Dec. 2, 1945. Objective analysis involves determination of pressures above given coordinates with a minimum of smoothing (to eliminate local or temporary irregularities or observational errors). This method satisfactory for determining pressure contours, streamlines, horizontal divergence and vertical velocities and fairly satisfactory for computing pressure gradients, but geostrophic deviations can only be determined reliably by falling back on subjective interpretations of apparent tendencies vs. possible errors or insufficiencies of data or smoothing methods. *Subject Headings:* **Weather map analysis, Objective forecasting.**—*M.R.*

3–31 551.509.317:551.515.127

Sawyer, J. S., **Formation of secondary depressions in relation to the thickness pattern.** Meteorological Magazine, [London], 79(931):1–5, Jan. **1950.** 3 figs., table, 4 refs. **DWB**—Formation of three types of secondaries studied in relation to thickness of 1,000–500 mb. layer: (1) At occlusion on warm front of slow primary when thickness isopleths crowd together (confluence) in front of point of occlusion; secondary breaks away. (2) At occlusion on cold front when thickness lines fan out (diffluence) ahead of warm front; usually short-lived. (3) At waves on warm front. Secondaries often form at left exit of a jet stream. Results useful for forecasting. *Subject Headings:* **Methods of forecasting, Cyclogenesis.**

3–32 551.509.33

Hofmann, Alfred, **Methoden der mittelfristigen Witterungsvorhersage.** [The methods of medium range forecasting.] Meteorologische Rundschau, 1(7–8):233–237, Jan.–Feb. **1948.** 5 figs., 4 refs. **DLC**—The author defines the limits of short, medium and long range forecasts as less than 36 hours, from 36 hours to 7 days, and over 7 days, respectively. Describes methods employed at Bad Kissingen (U. S. Zone, Germany) for medium range forecasting with the aid of (1) analogies, (2) correlations and (3) periodicities or "symmetry" points. Examples are given and the statement made that these methods are apt to be uncertain, especially in the spring and fall. *Subject Heading:* **Medium range forecasting.**—*M.R.*

3–33 551.509.39:551.575.1

Swinbank, W. C., **Prediction diagrams for radiation fog.** London, H. M. Stationery Office, **1949.** 9 p., 5 figs. ([Great Britain] Meteorological Office. Professional Notes No. 100.) At head of title: M. O. 420t. **DWB**—Probability of fog in England in Oct.–Nov. is plotted against (wind-shear)$^2$, depression of dew point and hydrolapse (vertical decrease of water vapor content). Another diagram gives time of fog formation in hours after sunset. *Subject Headings:* **Fog forecasting, Radiation fog.**

3–34 551.509.5:629.13

Gold, E., **The Prestwick air accident of 20 October 1948.** Weather, 5(1): 16–18, Jan. **1950. DWB**—Due to faulty chart of airport surroundings; meteorologists not to blame. *Subject Headings:* **Aeronautical meteorology, Prestwick, Scotland.**

3–35 551.509.59(62)

§El-Fandy, M. G., and Elnisr, M. K., **On the conditions favoring low stratus formation over the Middle East in summer.** American Meteorological Society, Bulletin, 30(10):357–359, Dec. **1949.** 4 figs., table, 4 refs. **DWB**—A short discussion of subsidence and the general vertical structure of the atmosphere over Egypt in summer, with examples and illustrative synoptic charts. *Subject Headings:* **Cloud forecasting, Egypt.**

3–36 551.509.8

Hesse, W., **Bringen zahlreiche Märznebel eine Gewitterhäufigkeit nach 100 Tagen?** [Do numerous March fogs bring frequent thunder 100 days later?] Wetter und Klima, 2(1–2):46–49, Jan.–Feb. **1949.** 4 tables. **DWB**—No statistical support for folk rhymes that much fog in March presages much thunder in summer. *Subject Headings:* **Weather lore, Thunderstorms, Statistical studies.**

3–37 551.509.8(43)

Hausmann, G., **Betrachtungen zum Altweibersommer in Potsdam im Zeitraum 1896–1945.** [On the Old Wives' Summer in Potsdam in the period 1896–1945.] Zeitschrift für Meteorologie, 3(8–9):269–272, Aug.–Sept. **1949.** 4 figs., 2 tables. **DWB**—The occurrence of a period of warm sunny days and cool clear nights in autumn in Potsdam was investigated statistically (pressure type was given less weight). It occurred in all but two years, between Aug. 26 and Oct. 24; frequency maxima Sept. 9, 16–24 (highest Sept. 21–23); secondary maxima Oct. 9–11 and 14; duration mostly 8–12 days, longest 29 in 1921. Its occurrence shows no relation to character of preceding summer. *Subject Headings:* **Weather lore, Statistical studies, Potsdam, Germany.**—*C.E.P.B.*

3–38 551.509.8(09)

Grimm, A. M., **Goethe als Wetterprophet.** [Goethe as weather prophet.] Zeitschrift für Meteorologie, 3(8–9):225–229, Aug.–Sept. 1949. **DWB**—Goethe was sensitive to changes of pressure and other weather. The article gives examples of his forecasts in letters to friends (1797–1830). *Subject Headings:* **Weather forecasting, Weather lore, History, Goethe.**—*C.E.P.B.*

# STRUCTURE AND PHYSICS OF THE ATMOSPHERE

## STRUCTURE OF THE ATMOSPHERE

3–39 551.510.42

Mrose, Helmut, **Chemische Aufgaben der Meteorologie.** [Chemical problems of meteorology.] Zeitschrift für Meteorologie, 3(4):110–113, April 1949. 16 refs. **DWB**—A general survey of the importance of small quantities of chemical impurities especially for precipitation and health. Condensation nuclei in Europe are mostly products of combustion. *Subject Heading:* **Atmospheric pollution.**—*C.E.P.B.*

3–40 551.510.42

Sherwood, T. K., **The geometry of smoke screens.** Journal of Meteorology, 6(6):416–419, Dec. 1949. 5 figs., 3 refs., 9 equations. Abstract p. 416. **DWB**—Application of Sutton's theory of turbulent dispersal to the problem of determining the form and dimensions of an artificial smoke cloud after a given time lapse. The clouds are ejected from smoke generators and data obtained therefrom can be used in checking turbulence theories as well as vice-versa. Nomograms are given for predicting concentrations and patterns downwind for single and multiple-generator screens. *Subject Headings:* **Smoke screens, Micrometeorology, Turbulence.**—*M.R.*

3–41 551.510.42:551.587(437)

Menzl, Oswald, **Bioklimatische Kernzählungen auf dem Donnersberg in Böhmen.** [Bioclimatic nuclear counts on the Donnersberg in Bohemia.] Meteorologische Rundschau, 1.(17–18):539–540, Nov.–Dec. 1948. 3 tables. Summary. **DWB**—*Subject Headings:* **Atmospheric pollution, Aerobiology, Czechoslovakia.**

3–42 551.510.5:551.515.8

Hesse, W., **Tropopausenschwankungen bei hochreichenden Kaltlufteinbrüchen.** [Variations of the tropopause with deep cold waves.] Zeitschrift für Meteorologie, 3(5–6):129–135, May–June 1949. 7 figs., 13 refs. **DWB**—Five types of tropopause are distinguished: among them Type II, inversion, includes 40%; and Type V, multiple tropopause, 13%. Deep cold waves are associated with advection of cold air between Atlantic high and a primary depression over northeast Europe, and a descending tropopause; this is gradually replaced by vertical movement and a rising tropopause. The cold wave of Nov. 15–21, 1942, is investigated in detail; graphs of day to day changes of temperature at 400, 300, 225 mb. and tropopause are shown for eight stations. Changes in lower troposphere and tropopause exceed those in upper troposphere. Height of 0°C. isotherm follows tropopause height. *Subject Headings:* **Atmospheric structure, Tropopause.**—*C.E.P.B.*

## MECHANICS AND THERMODYNAMICS

3–43 551.511

†Fultz, Dave, **A preliminary report on experiments with thermally produced lateral mixing in a rotating hemispherical shell of liquid.** Journal of Meteorology, 6(1):17–33, Feb. 1949. 14 figs., 3 tables, 21 refs., 8 equations. Abstract p. 17. **DWB**—Elaborate experiments were performed, using a thin inverted hemispherical shell of liquid, arranged so it could be rotated and heated from below (the pole), in an attempt to reproduce the circulation patterns of the earth's atmosphere. Experimental procedures are described in detail with numerous photographs of the equipment and the patterns produced when ink, or tobacco mosaic virus solutions were injected under varying conditions of heating. Results compared graphically with computations of zonal winds for winter and summer, and application made to calculation of relation

between rate of heating and total kinetic energy of relative circulation. Close agreement found between laboratory and natural circulations. *Subject Headings:* **Dynamics of the atmosphere, Planetary circulation.**—*M.R.*

3–44 551.511(4)

Höhn, R., **Meridionaler Massen- und Wärmeaustausch in der Troposphäre über Mitteleuropa.** [Meridional mass and heat exchange in the troposphere over central Europe.] Zeitschrift für Meteorologie, 3(8–9):252–253, Aug.–Sept. 1949. 2 tables. **DWB**—Author calculates 10-year means for each month of the meridional transport of mass across 1 meter of a parallel of latitude, finding $3.87 \times 10^7$ gm. per second. Meridional heat transport is: yearly $2.2 \times 10^7$ cal. per cm. per min., Dec. 4.6, July 0.3. Agrees roughly with calculations by Dalldorf (3.87) and theory by Baur (2.1). *Subject Headings:* **Thermodynamics of the atmosphere, Heat exchange, Europe.**—*C.E.P.B.*

3–45 551.511:551.552

Godson, Warren L., **Some remarks concerning the gradient-wind equation.** American Meteorological Society, Bulletin, 30(10):342–346, Dec. 1949. 3 figs., 9 refs., 14 equations. Abstract p. 342. **DWB**—The author shows that "supergradient" winds can be explained on the basis of an application of the gradient wind equation to the movements of high pressure centers and ridges aloft, since both roots of the binomial solution are valid. Possible solutions are shown graphically, and the theoretical development given in detail. *Subject Headings:* **Mechanics of the atmosphere, Gradient winds.**—*M.R.*

3–46 551.511:551.506.7

Hsieh, Yi-ping, **An investigation of a selected cold vortex over North America.** Journal of Meteorology, 6(6):401–410, Dec. 1949. 13 figs., 8 refs., 2 equations. Abstract p. 401. **DWB**—A detailed synoptic aerological study of an anomalous situation which occurred over the United States on March 2–8, 1947. A vortex of cold air detached itself from the cold air mass over the Yukon and moved southward into the belt of westerlies (over the Great Basin) then was slowly carried eastward as it intensified. The surface anticyclone below, meanwhile, decayed and in the final stages there was a cold cyclone with a vertical axis from the surface to the stratosphere. The author does not attempt to explain the intrusion of cold air, but does amply describe and illustrate the seclusion, the descending motion of cold air, increase of circulation, persistance of the residual cold dome, the movement and decay of the vortex, and the rainfall areas attending this outbreak. *Subject Headings:* **Vorticity, Upper air observations.**—*M.R.*

3–47 551.51

†Montgomery, R. B., **Vertical eddy flux of heat in the atmosphere.** Journal of Meteorology, 5(6):265–274, Dec. **1948.** table, 34 refs., 48 equations. Abstract p. 265. **DWB**—The author defines *eddy diffusivity* and develops the formula for energy flux from an open system in order to establish more precise terms for the vertical eddy flux of heat: (1) neglecting latent heat, and (2) including latent heat. Finally formulas are developed for the eddy flux of heat from dry ground and from moist ground, fresh water or salt water, and from ice. The separation of the heat transfer from the ocean to the atmosphere into (1) conduction and (2) latent heat of evaporation is considered artificial; the two being combined into one parameter in this work. Most of the fundamental papers in this field have been considered and listed as references. *Subject Headings:* **Thermodynamics of the atmosphere, Turbulent exchange.**—*M.R.*

3–48 551.51

Regula, Walter, **Entropie und Topographie.** [Entropy and topography.] Meteorologische Rundschau, 1(9–10):260–261, March–April **1948.** table, 3 refs., 3 equations. **DWB**—*Subject Headings:* **Thermodynamics of the atmosphere, Baric topography.**

3–49 551.511:551.510.52:551.587(43

Schneider-Carius, Karl, **Der Aufbau der Grundschicht im mitteleuropäischen Klimagebiet** [The structure of the surface layers in central-European climatic region.] Meteorologisch

Rundschau, 1(7–8):228–231, Jan. Feb. 1948. 8 figs. DLC—A discussion of the characteristic features of various types of tropospheric structure: lapse rates of temperature, humidity and hydrometeors as determined from airplane soundings up to 4 or 5 km. over Germany, at different seasons. The following types are described and illustrated by schematic diagrams: (1) Normal, (2) Convection, (3) Squally weather, (4) Inversion, (5) High fog and (6) Precipitation (thunderstorm and rain type). The surface as a frictional layer, the effect of orography on cloud and fog formation, and the means of identifying the above types are treated briefly. *Subject Headings:* **Thermodynamics of the atmosphere, Lapse rates, Structure of troposphere, Upper air climatology, Germany.**—*M.R.*

3–50 551.511

Spar, Jerome, **Energy changes in the mean atmosphere.** Journal of Meteorology 5(6):411–415, Dec. **1949.** 5 figs., 2 tables, 12 refs., 4 equations. Abstract p. 411. **DWB**—From data on mean temperature and pressure at various altitudes contained in the U. S. Weather Bureau Northern Hemisphere Chart Series, the author has attempted to compute the kinetic energy of mean motion of the atmosphere for January and July up to 20 km. He also computes the potential energy associated with the gravitational field, and the internal or thermal energy. The kinetic energy is shown to increase from summer to winter while the potential plus the internal energy decreases. Although the kinetic energy shows a greater *percentage* change from summer to winter (135% of the mean value) than does the potential and internal energy (3% of mean value), the *absolute* seasonal change of kinetic energy is only 1.3% of that of the potential plus internal energy change. *Subject Headings:* **Thermodynamics of the atmosphere, Northern Hemisphere.**—*M.R.*

3–51 551.511:551.551

Hardtwig, E., **Über den Aufbau der allgemeinen Turbulenz- und Austauschtheorie und die Formulierung des Austauschproblems.** [On the construction of the general theory of turbulence and "austausch" theory and the formulation of the "austausch" problem.] Zeitschrift für Meteorologie, 3(1–2):26–32, Jan.–Feb. **1949,** idem, 3(3):72–77, March **1949.** 13 refs., 93 equations. Summary in German p. 26. **DLC**—Author sets out to construct a mathematical theory of turbulence with the fewest possible assumptions. These include turbulence as a mechanical system, and ideas about an "element of turbulence"; transport of a property by the motion of such an element is according to the equations of transport; the velocity of the center of gravity of an element is the sum of the mean velocity and the component equations; the mass of an element is constant. He finally derives a series of difficult differential equations which cannot be solved (and if they could, he says, the results would not be worth the trouble!). The problem must be simplified by considering only variations in the vertical. *Subject Headings:* **Mechanics of the atmosphere, Turbulence.**—*C.E.P.B.*

## GENERAL CIRCULATION

3–52 551.513

Flohn, Hermann, **Zur Rolle des Oberpassats in der allegemeinen Zirkulation.** [On the role of the upper trades in the general circulation.] Meteorologische Rundschau, 1(1–2):23–24, July–Aug. **1947.** table, bibliog. **DWB**—A brief note on the winds at 10, 14 and 18 km. in low latitudes, with evidence of flow contrary to that of the trades. *Subject Headings:* **Atmospheric circulation, Trade winds, Upper air winds.**

3–53 551.513

Ramamurti, K. S., **Long-term longitudinal oscillation of the atmosphere in the vicinity of South America.** Journal of Meteorology, 6(1):63–65, Feb. **1949.** fig., 5 tables, 10 refs., 7 equations. Summary and conclusion p. 65. **DWB**—Statistical analysis of pressure data from 19 stations in South America, grouped according to latitude, to show meridional oscillations in pressure from year to year. The author claims that such variations are significant and hence may be used as an index to attempt forecasting winter precipitation in India. *Subject Headings:* **Zonal circulation, Pressure variations, South America.**—*M.R.*

3–54 551.513

†Yeh, Tu-cheng, **On energy dispersion in the atmosphere.** Journal of Meteorology, 6(1):1–16, Feb. 1949. 12 figs., 18 refs., 13+ equations. Abstract p. 1. **DWB**—Theoretical treatment of energy propagation through dispersive waves with special consideration of wave length, phase velocity and group velocity in four different atmospheric models. Graphs show relations of above elements as well as the distribution of phase resulting from an instantaneous point source disturbance, and the formation of a trough downstream from a region of cyclogenesis. Finally there is a treatment and illustration of the effect of blocking action and the latitudinal variation in intensity of disturbances or wave dispersion. Two applications are made to situations in the zone of westerlies of the Pacific and North America. *Subject Headings:* **Atmospheric circulation, Energy dispersion, Waves in the westerlies.**—*M.R.*

3–55 551.513:551.509.3

Charney, Jule G., **On a physical basis for numerical prediction of large-scale motions in the atmosphere.** Journal of Meteorology, 6(6):371–385, Dec. 1949. 6 figs., table, 16 refs. 45 equations. Abstract p. 371. **DWB**—Ignoring the influence of small-scale disturbances which complicate the calculations unnecessarily, an equation is derived for numerical calculation of large-scale atmospheric motions. This method is shown to be superior to smoothing techniques employed in connection with the standard hydrodynamical equations. Since there is an upper limit to the speed of propagation of disturbances, small disturbances at great distances or heights can be eliminated providing the time interval is small. In order to determine the actual magnitude of such influences, careful calculations of the influence function were made for $T=1$, 2, 3, 4, 5, 6, and 7 days and for 0° to 180° longitude at 45° latitude and the results presented in tabular form. Also curves are presented which show the relation between group and signal velocities for $A^2=18$ and $U=0$. Further discussion of the effect of vertical motions is followed by the conclusion that these methods can be satisfactorily used for the area of the Northern Hemisphere comprised by eastern U.S.A., the Atlantic and western Europe, for periods up to two days, ignoring small disturbances at remote parts of the globe, but that large-scale disturbances cannot be ignored so readily. *Subject Headings:* **Atmospheric circulation, Mathematical forecasting.**—*M.R.*

3–56 551.513:551.524:551.552

Riehl, Herbert and LaSeur, Noel E., **A study of high-tropospheric lapse rates with application to the construction of 300-millibar charts.** Journal of Meteorology, 6(6):420–425, Dec. 1949. 9 figs., 2 tables, 13 refs., 3 equations. Abstract p. 420. **DWB**—In the upper troposphere over North America the lapse rates are more stable in troughs than in ridges and are more stable north of the belt of maximum westerlies than to the south. In constructing 300 mb. charts from scanty data at that level and by extrapolation from 700 mb. charts, the above knowledge would be very useful as it would prevent the analyst from drawing contours on the assumption that the field is linear as he would if he assumed constant (normal) lapse rates from 700 to 300 mb. Charts show examples and graphs giving deviations from normal distribution of lapse rates. Also lee effect of Rocky Mountains (föhn or chinook effect) on lapse rates as determined from eight radiosonde stations, shown. *Subject Headings:* **Atmospheric circulation, Lapse rates, Upper troposphere.**—*M.R.*

3–57 551.513:551.557

Flohn, Hermann, **Eine äquatoriale Westwindzone als Glied der allgemeinen Zirkulation.** [An equatorial west wind zone as part of the general circulation.] Zeitschrift für Meteorologie, 3(8–9):240–246, Aug.–Sept. 1949. 3 figs., 26 refs. **DWB**—Recent upper wind observations show a narrow zone of west winds near the Inter-Tropical Convergence (ITC), generally about 1–5 km., separated from the trades by two sharp discontinuities or multiple transient convergent boundaries. Author discusses work of Fletcher (J. Meteor., 2, p. 167); a partial explanation is simply deflection of winds crossing equator but this does not apply to Pacific. Fletcher's down current above a warm layer is not accepted. Sections show a cold layer in doldrums at 1–3 km. above a warm layer, due to upward motion and radiation from clouds. This causes a high-level trough, deepest between 700 to 600 mb. The Indian summer ITC is a special case. Equatorial ocean countercurrent is analogous. *Subject Headings:* **Atmospheric circulation, Upper air winds.**—*C.E.P.B.*

3–58 551.513:523.74

Baur, Franz, **Die doppelte Schwankung der atmosphärischen Zirkulation in der gemässigten Zone innerhalb des Sonnenfleckenzyklus.** [The double oscillation of the atmospheric circulation in the temperate zone during the sunspot cycle.] Meteorologische Rundschau, 2(1–2):10–15, Jan.–Feb. 1949. 5 tables, 10 refs., 4 equations. Summary in German and English p. 10. **MH-BH**—New evidence is produced of the double fluctuation of meteorological elements during the sunspot cycle in two long series (rainfall of central Europe and frequency of very warm months), and it is shown that the variations cannot be due to random sampling. A new index of solar activity based on the areas of faculae and sunspot numbers is proposed. *Subject Headings:* **Atmospheric circulation, Sunspots.**—*C.E.P.B.*

3–59 551.513.1

Sellick, N. P., **Equatorial circulations.** Royal Meteorological Society, Quarterly Journal, 76(327):89–94, Jan. 1950. fig., 4 refs., 8 equations. Summary p. 89. **DWB**—A frictionless flow pattern near the equator is developed mathematically. Clockwise and counter clockwise circulations can exist in equilibrium, the centers of pressure fields being displaced into the hemisphere for which the circulation is cyclonic. Trajectories and contours may cross equator at any angle, but there is little relation between contours and winds. Patches of high pressure are associated with centers of cols rather than with anticyclonic circulations. *Subject Headings:* **Atmospheric circulation, Tropical Meteorology.**

## ATMOSPHERIC DISTURBANCES

3–60 551.515:551.577:551.589.1(474)

Maede, Hans, **Der jährliche Witterungsablauf im Spiegel der Regenwetterlagen an der südlichen Ostseeküste.** [The annual variation of weather as a reflection of the rainy weather situations on the south Baltic coast.] Zeitschrift für Meteorologie, 3(8–9):253–260, Aug.–Sept. 1949. fig. **DWB**—The frequency variation of weather situations with a rainfall of 1 mm. or more in a day at Greifswald is investigated. Monthly frequencies are given with: thunder, cyclone centers, north/northwest shower type, southeast and westerly types, shown graphically, and discussed month by month in relation to frequency of weather types. This gives a "synoptic-dynamic insight" into some of the peculiarities of weather. *Subject Headings:* **Synoptic climatology, Precipitation, Baltic.**—*C.E.P.B.*

3–61 551.515.3

Phillips, P. E., **Flight through cloud funnel of waterspout.** Meteorological Magazine, [London], 79(931):24–25, Jan. 1950. **DWB**—Pilot's brief account of conditions encountered while deliberately flying through a waterspout near Singapore. *Subject Heading:* **Waterspouts.**

# RADIATION AND TEMPERATURE

## RADIATION

3–62 551.508.21:551.521

Robinson, G. D., **Notes on the measurement and estimation of atmospheric radiation—2.** Royal Meteorological Society, Quarterly Journal, 76(327):37–51, Jan. 1950. 9 figs., 6 tables, refs. Summary p. 37. **DWB**—Extension of Quarterly Journal 73, 1947, p. 127 by further observations with a Linke-Fuessner radiometer on seven sky zones at Kew. Errors of "Kew" chart of radiative flux and Elsasser's chart (1942) discussed. Emissivity shows nearly linear relation to log radiating length (cm. water+$CO_2$) and a probable increase with temperature. There is also a variable component attributed to dust. Radiative heating and cooling of air were measured between 20 and 120 cm. Radiative temperature at 1 m.h. 0.25°C. higher at night and 0.5° lower by day than surface temperature, large scatter. *Subject Headings:* **Radiometers, Radiation.**

3–63 551.521.31:551.593.7:551.593.53

*Wörner, H., **Messung der Sonnenstrahlung, der Himmelspolarisation und der Blaufärbung der Himmelslichtes.** [Measurements of solar radiation, sky polarization and the

blue of the sky.] Zeitschrift für Meteorologie, 3(5–6):166–169, May–June **1949.** fig., 3 tables. **DWB**—Three hundred thirty-two observations June–Dec. in Gotha. Turbidity (Trübung) shows maximum in July; greatest with sub-tropical air and least with maritime arctic air. Polarization of blue-sky light decreases with increasing sun height and increasing turbidity. *Subject Headings:* **Solar radiation, Polarization, Turbidity.** —*C.E.P.B.*

3–64 551.521.1

Berg, Hellmut, **Ergebnisse von Messungen der Globalstrahlung in Bochum.** [Results of measurements of global radiation in Bochum.] Zeitschrift für Meteorologie, 3(5–6):153–161, May June **1949.** 8 figs. **DWB** -Mean daily totals of radiation (sun+sky) from a Robitzsch bimetallic pyranograph in 51°29′N., 7°13′E., 118 m. are given monthly, 1938–1944 with 5-day means and frequency distribution. Relations to duration of sunshine and amount of cloud in June and December are illustrated and equations discussed. Relations to visibility and atmospheric impurities are illustrated. *Subject Headings:* **Global radiation, Germany.**—*C.E.P.B.*

3–65 551.521.31:69

Berg, Hellmut, **Die Schwächung der direkten Sonnenstrahlung durch Reflexion beim Durchgang durch eine Glasscheibe.** [Weakening of direct solar radiation by reflection during passage through a glass sheet.] Wetter und Klima, 2(1–2):23–32, Jan.–Feb. **1949.** 2 figs. 2 tables, 2 equations. **DWB**—Relation between reflected and transmitted radiation through glass windows or roofs depends on angle of incidence of rays. With small absorption and high angle of incidence, it also depends on polarization of light in relation to plane of glass. Table 1 gives hourly values for latitude 50° of radiation through glass for south, north, east and west aspects; inclination of plate 0–90° for summer and winter solstices and equinoxes. Table 2 gives daily sums. *Subject Headings:* **Solar radiation, Building design, Solar houses.**—*C.E.P.B.*

3–66 551.521.3

Bolz, H. M., and Falckenberg, G., **Neubestimmung der Konstanten der Ångströmischen Strahlungsformel.** [New determination of the constants of Ångström's radiation formula.] Zeitschrift für Meteorologie, 3(4):97–100, April **1949.** 4 figs., 21 refs. **DWB**—Ångström's formula for infrared atmospheric counterradiation (G) is:

$$G = \sigma T^4 (a - b.10^{-c\epsilon})$$

where $\epsilon$ is vapor pressure in mm. Fig. 1 shows variation of $G/\sigma T^4$ with $\epsilon$, found by 8 investigators (1916–1948). Authors found $a = 0.820$, $b = 0.250$, $c = 0.126$; 70% of 1,332 measurements differed by 5% or less from this expression. The apparatus ("vibration pyranometer") is described; values given by it are ca. 6% above those previously found. G increases with turbidity, especially with sea winds, and is high in stationary anticyclones. *Subject Headings:* **Global radiation, Actinometers.**—*C.E.P.B.*

3–67 551.521.3

Möller, Fritz, **Streustrahlung des atmosphärischen Dunstes und sekundäre Diffusion.** [The scattered radiation of atmospheric fumes and secondary diffusion.] Meteorologische Rundschau, 1(7–8):212–215, Jan.–Feb. **1948.** fig., 5 tables, 8 refs., 11 equations. Summary in German p. 212. **DLC**—*Subject Headings:* **Scattering, Atmospheric pollution.**

3–68 551.521.3:551.593.54

Malsch, Wolfgang, **Messungen der atmosphärischen Extinktion und ihre Beeinflussung durch meteorologische Faktoren.** [Measurements of atmospheric extinction, and the influence of meteorological factors on them.] Meteorologische Rundschau, 2(1–2):5–10, Jan.–Feb. **1949.** tables, 7 refs., 2 equations. **MH-BH**—Transmission coefficients were found by photometer measurements on stars at Cologne, Nuremberg and Karlsruhe, and converted to Linke's turbidity (Trübung) factor. The values depend on the aerological condition of the atmosphere and on the wind direction in relation to the position of towns. The transmission coefficient varies rapidly and astronomical extinction tables are not valid near towns. *Subject Headings:* **Turbidity, Atmospheric extinction.**—*C.E.P.B.*

3–69 551.521.31

Wegener, Kurt, **Die Absorption der Sonnenstrahlung in der Atmosphäre.** [The absorption of solar radiation in the atmosphere.] Meteorologische Rundschau, 2(5–6):174–175, May–June 1949. fig. **DWB**—Author considers that the accepted formula for calculating solar constant from Abbott's "waterflow" and "waterstir" actinometers is incorrect. *Subject Heading:* **Solar radiation.**

## TEMPERATURE

3–70 551.524.31

Small, Robert T., **The use of wind machines and helicopter flights for frost protection.** American Meteorological Society, Bulletin, 30(3):79–85, March 1949. 7 figs., table, ref. Abstract. **DWB**—The author presents tabular and graphical data obtained during two tests of the usefulness of mechanical methods of mixing the air under conditions of frost in orchards of Southern California. Limitations stressed. Under severe conditions heaters are more efficient. *Subject Headings:* **Frost protection, Wind machines, Helicopters.**—*M.R.*

3–71 551.524.4:551.576.1

Prügel, Heinrich, **Abendthermik mit Cumulusbildung im Flachland.** [Evening thermal with cumulus formation over low ground.] Zeitschrift für Meteorologie, 3(4):118–119, April 1949. **DWB**—A rare case of an evening "thermal" (up-current above 300 m.) at Gatow on June 10, 1943, is attributed to strong sunshine followed by the advance of a strato-cumulus deck which hindered stabilization of the lower layers in the evening. *Subject Headings:* **Thermals, Cloud formation, Germany.**—*C.E.P.B.*

3–72 551.524(432.1)

Naegler, Wilhelm, **Dauer der wichtigsten Temperatur-Perioden in Sachsen.** [Duration of the most important temperature periods in Saxony.] Meteorologische Rundschau, 1(9–10):298–299, March–April 1948. table. **DLC**—*Subject Headings:* **Temperature periodicities, Saxony, Germany.**

3–73 551.524.3(43)

Naegler, Wilhelm, **Die mildesten Winter in Leipzig (1829 bis 1948) mit besonderer Berücksichtigung des Winters 1947/1948.** [The mildest winters in Leipzig (1829–1948) with special reference to the winter of 1947/1948.] Zeitschrift für Meteorologie, 3(1–2):9–12, Jan.–Feb. 1949. 2 tables, 2 refs. Summary p. 9. **DLC**—Author summed positive daily mean temperatures at Leipzig Nov.–Feb., largest sum 1934–1935. Very mild winters have been increasingly frequent since 1862; no periodicity found. After very mild winters there is generally a cold period in March or April. Winter 1947–1948 was the rainiest since 1828. *Subject Headings:* **Temperature variations, Abnormal winters, Germany.**—*C.E.P.B.*

3–74 551.524.32:63

Weger, Nikolaus, **Die Temperaturanomalie von Frei-Weinheim und ihre Bedeutung für die Landwirtschaft.** [The anomalies of temperature in Frei-Weinheim and their importance for agriculture.] Meteorologische Rundschau, 1(7–8):208–210, Jan.–Feb. 1948. fig., 2 tables. **DLC**—*Subject Headings:* **Temperature anomalies, Agricultural meteorology, Germany.**

3–75 551.524.33(43)

Goldschmidt, H., and Reuter, A., **Über die Periodizitäten der strengen Winter im östlichen Mitteldeutschland.** [On the periodicity of severe winters in east central Germany.] Zeitschrift für Meteorologie, 3(1–2):1–8, Jan.–Feb. 1949. 2 figs., 4 graphs, table, 12 refs. Summary in German p. 1. **DLC**—Authors calculated the sums of negative daily mean temperatures (Nov.–March) at or near Wahnsdorf for each year 1828–1948. There were symmetry points in 1854 and 1912. Severe winter were frequent before 1881 and after 1939, rare between these dates. Shorter periodicities: 1828–1875, 5, 8 and 11 years, possibly also 9 and 10; 1875–1939, 2.4, 5.3 and especially 7 years, no 11-year. *Subject Headings:* **Temperature periodicities, Abnormal winters, Germany.**—*C.E.P.B.*

3–76 551.524.36(43)

Witterstein, Franz, **Die Differenz zwischen Hütten- und Erdbodenminimumtemperaturen nach heiteren und trüben Nächten in Geisenheim/Rheingau.** [The difference between screen and grass minimum temperatures on clear and overcast nights in Geisenheim/Rheingau.] Meteorologische Rundschau, 2(5–6):172–174, May–June **1949.** 3 figs. **DWB**—Grass minima on clear nights average 2–3°C. lower than screen minima; difference greatest May and November, least February and July. On overcast nights the difference averages less than 1°. Frequency curves of differences are given; negative differences occur only on overcast nights in winter. *Subject Headings:* **Temperature inversions, Microclimatology, Germany.**—*C.E.P.B.*

3–77 551.524.36:551.583.15(43)

Schindler, Gerhard, **Vor- und Gesamtwinter im Jenaer Raum.** [Early and whole winter in the region of Jena.] Zeitschrift für Meteorologie, 3(4):113–114, April **1949. DWB**—Defines a severe winter as one with accumulated negative temperatures Oct.–April of 332°C. or more (normal 224°). Lists 36 such winters in Jena 1771–1947; in most of these 112° was reached by end of December, in eight cases by mid-January; only four exceptions. *Subject Headings:* **Abnormal winters, Jena, Germany.**—*C.E.P.B.*

3–78 551.524.4

Brocks, Karl, **Die Höhenabhängigkeit der Lufttemperatur in der nächtlichen Inversion.** [The dependence of air temperature on height in the nocturnal inversion.] Meteorologische Rundschau, 2(5–6):159–167, May–June **1949.** 5 figs., 8 tables, 21 refs. Summary in German p. 159. **DWB**—The nocturnal thermal stratification in the lowest 300 m. over low ground in central and western Europe is studied. In the lowest 20 m. it is represented by $\partial t/\partial z$ (°/100 m.) $= az^b$, where a is 15–30°C. and b is $-0.8$ to $-1$. This lower inversion layer persists on clear nights from 1¾ hr. before sunset to 1⅔ hr. after sunrise; it deepens during night but is most stable soon after sunset. After midnight temperature falls more in upper than lower layers. Variation of actual temperature with height is also represented by a power law (exponent less than 0.2). Causes are discussed. *Subject Heading:* **Temperature inversions.**—*C.E.P.B.*

3–79 551.524.4(494.1)

Ekhart, E., **Über Inversionen in den Alpen.** [On inversions in the Alps.] Meteorologische Rundschau, 2(5–6):153–159, May–June **1949.** 4 figs., 4 tables, 6 refs. Summary in German and English p. 153. **DWB**—The depth, intensity and stability of inversions at Klagenfurt (inner Alpine valley) are studied from two years daily radiosondes. The lower limit was nearly always below 200 m., upper limit below 600 m. Diagrams show frequency distribution and relation of amount to depth, for ground and free inversions. Annual variation of frequency, depth and gradient is shown for both types. Finally the life history of an inversion on Sept. 22–23, 1941 is illustrated and described. *Subject Headings:* **Temperature inversions, Alps, Germany.**—*C.E.P.B.*

## ATMOSPHERIC PRESSURE AND WIND

### PRESSURE

3–80 551.542

*Assur, Andreas, **Neue Breitenmittel des Luftdrucks für Januar, Juli und das Jahr.** [New latitude means of pressure for January, July and the year.] Meteorologische Rundschau, 2(3–4):92–93, March–April **1949.** 13 refs. **MH-BH**—Mean pressure is given in mb. for each 5° from 90°N. to 90°S. Skeleton summary:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Maxima, 1000 mb.+ | | | | | | | | |
| January | 90°N. | 13.3 | 35°N. | 20.0 | 35°S. | 15.9 | 90°S. | −2.2 |
| July | 80°N. | 11.4 | 40°N. | 13.9 | 30°S. | 20.0 | 90°S. | −3.7 |
| Minima | | | | | | | | |
| January | 80°N. | 12.5 | 5°S. | 10.3 | 65°S. | −12.6 | | |
| July | 65°N. | 9.9 | 10°N. | 10.9 | 65°S. | −14.2 | | |

*Subject Heading:* **Pressure distribution.**—*C.E.P.B.*

3–81 551.543.1:551.590.2(02)

Wilkes, M. V., **Oscillations of the earth's atmosphere.** Cambridge, [England], University Press, **1949.** 74 p., 23 figs., 9 tables, refs. (Cambridge monographs on physics.) **DLC**—A short textbook on the forced oscillations of the atmosphere caused by gravitation (tides) and solar radiation. Chapter I gives history of observation and theory of solar and lunar atmospheric tides at surface and lunar semidiurnal tide in ionosphere, including Chapman's statistical analyses. Chapter II sets out mathematical theory of oscillations in a rotating atmosphere, including derivation of Laplace's tidal equation, and discusses various solutions, especially the semidiurnal. In Chapter III the numerical evaluation of this equation is examined and it is shown that a forced oscillation of the atmosphere requires an upward flow of energy at a level just below that at which effects of absorption (damping) become operative. Chapter IV relates oscillations of the atmosphere to temperatures at great heights. The treatment is based on trapping of tidal energy in the atmosphere and the dependence of the resonance theory on the existence of barriers. It is shown that under certain conditions sharp resonance exists near 12 h. The results are discussed in Chapter V; the general features of both lunar and solar tides can now be explained but some difficulties remain. *Subject Headings:* **Pressure variations, Cosmic influences, Textbooks.**—*C.E.P.B.*

3–82 551.547:629.13

§Great Britain Meteorological Office, **Theoretical aspects of pressure pattern flying.** Compiled by J. S. Sawyer. London, H. M. Stationery Office, **1949.** 64 p., 24 figs., 7 tables, 50 refs., equations, 5 append. ([Great Britain] Meteorological Office, Meteorological Reports, No. 3.) At head of title: M. O. 496c. **DWB**—Pressure pattern flying is route planning by synoptic chart. (a) Pressure altimeter and radar altimeter give pressure at a known height and pilot can find horizontal pressure gradient and drift at right angles to track, to help fix position and course. (b) "Single heading flight" lays down course to be followed with existing system of winds—useful for aircraft without navigators, or pilotless. (c) "Least time track" obtains minimum time of flight and avoids bad weather by preflight planning. Procedure recommended uses head-wind components normal to track. (d) In-flight modification of flight plan based on (a) is of doubtful value. Practical procedure and errors are described. Average time saved over great circle route London–New York at 200 kt. is 1 hour by (b) and 2½ hours by (c). *Subject Headings:* **Aeronautical meteorology, Upper air pressure.**

3–83 551.547.3:551.577.3

Höhn, R., **Der Jahresverlauf der absoluten und relativen Topographie der 500-mb. Fläche für einige europäische Stationen auf Grund zehnjähriger Monats- und Tagesmittel.** [The annual variation of the absolute and relative topography of the 500-mb. surface for some European stations on the basis of 10 year monthly and daily means.] Zeitschrift für Meteorologie, 3(5–6):143–147, May–June **1949.** 2 figs., table. **Verlauf des Druck- und Temperaturgefälles in der Höhe über Mitteleuropa.** [Variation of the pressure and temperature gradients in the upper air over central Europe.] idem, p. 148–153. 5 figs. **DWB**—(1) Monthly means 1935–1944 of absolute and relative topography of 500 mb. surface are given for Aberdeen, Paris, Hamburg, Warsaw, Stockholm. Smoothed daily means show singularities and symmetry points, which are discussed in detail. (2) From the differences between these stations mean monthly and daily gradients, vector and scalar winds, and "constancies" are calculated. The computed winds are west northwest in summer and northwest in winter with marked variations of speed and direction, forming singularities grouped about symmetry points in early August and late January. These agree with those found in (1). *Subject Headings:* **Baric topography, Upper air pressure, Upper air winds, Central Europe.**—*C.E.P.B.*

## WIND

3–84 551.552

Penndorf, R., **Häufigkeit der Windrichtungen über dem nördlichen Vorland der Karpaten in 1,000 m Höhe.** [Frequency of wind directions over the northern foothills of the Carpathians at a height of 1,000 m.] Zeitschrift für Meteorologie, 3(1–2):42–43, Jan.–Feb. **1949.** fig., table. Summary in German p. 42. **DLC**—Winds at 1,000 m. show a preponderance parallel to Carpathians combined with a monsoon-like effect (northwest in summer, southwest in winter). *Subject Headings:* **Upper air winds, Carpathians, Central Europe.**—*C.E.P.B.*

3–85 551.553.8(43)

Malsch, Wolfgang, **Die Häufigkeit von starken und stürmischen Winden in der Rheinebene.** [Frequency of strong winds and gales in the Rhine plain.] Wetter und Klima, 2(3–4):111–112, March–April **1949.** **DWB**—Monthly and annual frequencies of winds equal to or exceeding forces 6, 8, at Karlsruhe (1901–30). No relation to sunspots. *Subject Headings:* **Gales, Wind frequencies, Germany.**—*C.E.P.B.*

3–86 551.553.12:551.515.8

Scherhag, Richard, **Eine neue Theorie des Berg- und Talwindes mit Anwendung auf den Mechanismus der Fronten.** [A new theory on mountain and valley breezes with application to the mechanism of fronts.] Meteorologische Rundschau, 1(7–8):220–222, Jan.–Feb. **1948.** 3 figs., 3 refs. Summary in German and English p. 220. **DLC**—Land and sea breezes result from mass transport aloft, whereas mountain and valley breezes originate in the surface layers and the flow aloft is merely to compensate for the surface flow. By analogy a model of the upward flow along an air-mass boundary or frontal surface, and compensating currents aloft, can be developed. *Subject Headings:* **Mountain and valley breezes, Fronts.**—*M.R.*

3–87 551.553.21:551.509.31:(54)(591)

Tun Yin, Maung, **A synoptic-aerologic study of the onset of the summer monsoon over India and Burma.** Journal of Meteorology, 6(6):393–400, Dec. **1949.** 9 figs., 18 refs. Abstract p. 393. **DWB**—Analysis of 3 km. and 8 km. pressure and air-flow charts over southeast Asia show that the onset of the monsoon occurs in connection with a westward displacement of the high-level trough, a disintegration of the branch of the *jet stream* which prevails south of the Himalayas in spring, and a southward movement of the trough and *jet stream* over Siberia. The monsoon strikes Burma somewhat earlier than India, the bursts over India occurring only when the high-level trough recedes to the north and west. Detailed streamline charts for the 3 km. level are presented for the period May 21 to June 12, 1946, and meridional displacement of troughs, jet streams and ridges with time, are presented graphically to show the discontinuity which occurs in connection with the onset or burst over India. The cause, however, still lies in differential heating which was recognized by Halley in 1686. *Subject Headings:* **Monsoons, Synoptic-aerological studies, Jetstream, India, Burma.**—*M.R.*

3–88 551.555.1:551.524.371

Faust, Heinrich, **Untersuchungen von Forstschäden hinsichtlich der Windstruktur bei einer Bö.** [Investigations of forest damages with regard to the wind structure of a squall.] Meteorologische Rundschau, 1(9–10):290–297, March–April **1948.** 7 figs., 3 refs. Summary in German p. 290. **DLC**—*Subject Headings:* **Squalls, Wind damage, Forests.**

3–89 551.555.4(98)

Vize, V. IU., [W. Wiese], **Novozemel'skaia bora.** [Bora of Novaya Zemlya.] Tsentral'noe Gidromet. Biuro, Izvestiia, Issue V., **1925.** illus., charts, graphs. **DPL**—A thorough analysis of the synoptic conditions preceding and accompanying the bora, the elements or combination of elements during the bora, and the effect on human beings. Similarity of the bora in winter to the williwaw (or Taku) of Alaska and in summer to the föhn or chinook, is evidenced by the drop in humidity, clearing skies, föhn clouds and strong gusty winds. Many tables giving temperature wind roses, wind chill factor, pressure and wind, etc., show an advanced attitude toward climatology not usually found in works of that date. *Subject Headings:* **Boras, Climatology, Novaya Zemlya, U.S.S.R., Arctic.**—*M.R.*

3–90 551.547:551.557

Godson, Warren, L., **A study of the deviations of wind speeds and directions from geostrophic values.** Royal Meteorological Society, Quarterly Journal, 76(327):1–15, Jan. **1950.** 6 figs. **DWB**—Geostrophic wind and angle with observed wind computed for 618 10,000 ft. winds in North America. Mean deviation 15°, more for speeds below 15 m.p.h. and hence in low latitudes. Mean cross wind 5 m.p.h., mean vector difference 7 m.p.h. North of 30° for speeds 20–45 m.p.h. deviation of observed from geostrophic speed is ca. 20%, otherwise more. South of 30° and for low speeds geostrophic wind helps little. Above 50 m.p.h. curvature

must be considered. Mean acceleration, radius of curvature, horizontal and vertical advection are also discussed. *Subject Headings:* **Upper air pressure, Upper air winds, Geostrophic winds.**

3–91 551.506.7:551.557

Murgatroyd, R. J., and Clews, C. J. B., **Wind at 100,000 ft. over south-east England; observations and a discussion of the monsoon theory of wind at great heights.** London, H. M. Stationery Office, **1949.** 14 p., 5 figs., 3 tables, 5 refs. ([Great Britain] Meteorological Office. Geophysical Memoirs, No. 83.) At head of title: M. O. 499c. **DWB** –Winds at 100,000 ft. observed by drift of 35 shell bursts in 1944–1945 were mainly strong northwest-southwest in winter (up to 130 km.) and moderate northeast-southeast in summer. Temperatures up to 60,000 ft. at Larkhill and Lerwick gave thermal winds agreeing with these observations. *Subject Headings:* **Upper air observations, Upper air winds, England.**

3–92 551.557(43)

Berg, Hellmut. **Die Höhenwindverhältnisse über Westdeutschland.** [Upper winds over west Germany.] Wetter und Klima, 2(3–4):97–103, March–April **1949.** 2 figs., 9 tables, 4 refs. **DWB** –Based on 372 radio ascents, various places July 1942–Dec. 1944. Gives vector and scalar mean winds, constancy, frequencies of directions for months and seasons, and interdiurnal variability (Sept.) by km. heights up to 20 km. Scalar velocity shows a maximum at 10 km. at all seasons, falls rapidly to 14–16 km., then nearly constant. *Subject Headings:* **Upper air winds, Germany.**—*C.E.P.B.*

3–93 551.557:551.509.317

Crowson, Delmar L., **On the variability of upper winds at Eniwetok, Marshall Islands.** American Meteorological Society, Bulletin, 30(10):347–351, Dec. **1949.** 3 figs., 3 tables, 6 refs. Abstract p. 347. **DWB**—As a result of 25 upper air wind soundings made with electronic equipment during a period of only 33 hours in May 1948, there is evidence of a much greater variability in winds at high levels than was expected. At 30,000 or 40,000 feet the maximum winds vary by 50 to 100% in an hour, even with high initial speeds, presenting a serious problem for forecasters with only occasional data available. Detailed analysis of results shown graphically and in tables. *Subject Headings:* **Upper air winds, Forecasting winds aloft.**—*M.R.*

## VERTICAL MOTION

3–94 551.558:797.5

Bell, G. J., **Some meteorological aspects of soaring flight.** Weather, 5(1):8–13, Jan. **1950.** 3 photos. **DWB**—General account of the causes of rising currents—convection, cold fronts, slopes, standing waves behind hills, gravity waves at inversions. *Subject Headings:* **Vertical motion, Gliding.**

3–95 551.558

Kiveliovitch, M., **Sur la composante verticale du vent. Première Partie.** [On the vertical component of wind. First Part.] Journal Scientifique de la Météorologie, 1(1):18–22, Jan.–March **1949.** 2 refs., 22 equations. Summary in French, English and Spanish p. 18. **DWB**—An attempt to formulate the vertical motion of the wind, based on the hydrodynamic equation and assuming geostrophic wind, adiabatic changes and linear lapse rate (negligible acceleration). An extension of a similar study by the author on the vertical motion in the turbulent layer. *Subject Heading:* **Vertical motion.**—*M.R.*

3–96 551.558.2:551.513.1:551.509.312

*Lettau, Heinz, **Über wetterwirksame Vertikalbewegungen und ihre Ermittlung aus dem Druckfeld.** [1. Teil.] [On weather-producing vertical motions and their investigation from the field of pressure. (I. Part.)] Meteorologische Rundschau, 1(9–10):257–260, March–April **1948.** table, 7 refs., 20 equations. Summary in German and English p. 257. **2. Teil, Das Höhendruckfeld unter besonderer Berücksichtigung des stationären Höhentiefs oder Kaltlufttropfens.** [II. Part. The high pressure field with special consideration of stationary anticyclones or cold air pools.] idem, 1(17–18):519–523, Nov.–Dec. **1948.** 8 refs., 23 equations. Summary p. 519. **MH-BH, DLC**—In Part I, the author gives the theory of vertical

motion as well as some actual derived data (for Dec. 10, 1937) for many places in Germany, Holland, France and Denmark, on the amount of effective vertical motion under cyclonic conditions. In Part II, the stationary anticyclone or "sink" is considered. The vertical motion, according to Lettau, is determined by the deviation from the geostrophic flow. Simplified Exner expressions can be used in calculations. *Subject Headings:* **Vertical motion, Mechanics of the atmosphere, Anticyclones.**—*M.R.*

3–97 551.558

Miller, James E., **Vertical motions of the atmosphere.** Weather, 5(1):2–7, Jan. **1950.** 3 figs., 3 refs. **DWB**—Summary of recent work in the United States on the adiabatic and kinematic methods of computing the vertical component of velocity of air masses. *Subject Heading:* **Vertical motion.**

3–98 551.558

Regula, Herbert, **Ermittlung von Vertikalbewegungen und Strahlungswirkung durch Vergleich von Aufstiegskurven.** [Investigation of vertical motion and effect of radiation through comparison of radiosonde curves.] Meteorologische Rundschau, 1(7–8):231–233, Jan.–Feb. **1948.** 2 figs., table, 2 refs. Summary in German p. 231. **DLC**—*Subject Headings:* **Vertical motion, Radiation.**

## AQUEOUS VAPOR AND HYDROMETEORS

### WATER VAPOR AND CLOUDS

3–99 551.571.7:551.510.53

Shellard, H. C., **Humidity of the lower stratosphere; the results of high-level ascents by aircraft of the Meteorological Research Flight.** Meteorological Magazine, [London], 78(930):341–349, Dec. **1949.** 7 figs., 2 tables, 2 refs. **DWB**—Results of 64 flights reaching stratosphere are discussed, with tropopause as reference level. A more precise definition is given of Types I, II, III of tropopause. Mean R.H. drops from 43% at tropopause to 5.3% 25 mb. above and 2.7% 75 mb. above. Fall of frost point from 50 mb. below to 50 mb. above, 5.8°F. in Type I, 1.9 in Type II. There is often a discontinuity in frost point in Type I, but not in Type II. Significant correlation is found between frost point and pressure and temperature. *Subject Headings:* **Upper air humidity, Stratosphere, Tropopause.**

3–100 551.574.1

Richter, Gertraud, **Der Kerngehalt der Luft in Karlsbad.** [The condensation nuclei content of air in Karlsbad.] Meteorologische Rundschau, 1(9–10):273–275, March–April **1948.** fig. **DLC**—*Subject Headings:* **Condensation nuclei, Germany.**

3–101 551.574.7

Becker, Richard, **Eine einfache Methode zur klimatologischen Darstellung der Vereisungsgefahr.** [A simple method for the climatological determination of the risk of icing.] Meteorologische Rundschau, 2(5–6):175–176, May–June **1949.** 9 figs. **DWB**—Areas of greatest risk of icing Oct.–June are calculated from surface air isotherms, an assumed lapse of 0.6°C./100 m., and frequency of rainfall. *Subject Heading:* **Icing in clouds.**—*C.E.P.B.*

3–102 551.576.1:551.594.21

Workman, Everly J., and Reynolds, S. E., **Time of rise and fall of cumulus cloud tops.** American Meteorological Society, Bulletin, 30(10):359–361, Dec. **1949.** fig., table, ref. **DWB**—Description and analysis of data obtained from photography and radar measurements of convective cells or nodules rising from tops of cumulus clouds in New Mexico. It is shown that the cells subside with nearly the same speed as they rise, and that the standard deviation is small for this type of activity. *Subject Headings:* **Cloud structure, Thunderstorm electricity.**—*M.R.*

3–103 551.576.11

Prügel Heinrich, **Wolkenstrassen bei schwachen Winden.** [Cloud stripes with light winds.] Annalen der Meteorologie, 2(3–4):99–104, March–April **1949.** 4 figs., 3 refs. Summary in German and English p. 99. **DWB**—Three occasions of cloud stripes with light winds are examined using upper air data. They require a sufficiently strong gradient wind to overcome local circulations, a temperature lapse equal to or exceeding the wet adiabatic, and intercalated layers of small gradient or inversion. Cloud stripes occur in temperate and arctic but not subtropical air masses, and increase in frequency with the wind speed. *Subject Heading:* **Cumulus clouds.**—*C.E.P.B.*

3–104 551.576.12

Scultetus, H. R., and Schön, W., **Dämmerungscirren; Dämmerungscirren am 27 Juni, 1948.** [Twilight cirrus; twilight cirrus on the 27th of June 1948.] Zeitschrift für Meteorologie, 3(5–6):175–176, May–June **1949. DWB**—*Subject Heading:* **Cirrus clouds.**

## RAINFALL

3–105 551.577.22

Newnham, E. V., **Relationship between the average monthly rainfall and the average number of days per month with 0.4 in. or more of rain.** Meteorological Magazine, [London], 79(931):12–14, Jan. **1950.** 2 figs., table. **DWB**—In temperate regions days per month with 0.4 in. or more is given by 0.9 (rainfall in inches)—0.4. At tropical stations relation is represented by a curve concave downwards. *Subject Heading:* **Precipitation distribution.**

3–106 551.577.36:551.515.13(411)

§Hay, R. F. M., **Rainfall in east Scotland in relation to the synoptic situation.** London, H. M. Stationery Office, **1949.** 17 p., 4 figs., 5 tables, 7 refs. ([Great Britain] Meteorological Office. Professional Notes, No. 98.) At head of title: M. O. 420r. **DWB**—Based on hourly rainfalls at Aberdeen 1926–1930. Tracks of all depressions giving 3+ mm. were classified and average seasonal rainfall with each tabulated. Most heavy falls are related to warm occlusions moving east northeast-north, the center passing more than 60 miles to south. This is discussed in connection with structure of depressions. *Subject Headings:* **Precipitation frequencies, Structure of depressions, Scotland.**

3–107 551.577.37:629.13

Sawyer, J. S., **Possible effects of heavy rain on aircraft.** London, H. M. Stationery Office, **1949.** 7 p., table, 7 refs. ([Great Britain] Meteorological Office. Professional Notes, No. 99.) At the head of title: M. O. 420s. **DWB**—Downward currents are observed by pilots in heavy tropical rain. Downward thrust from impact of rain and weight of rain on aircraft are insignificant. Most important factor is cooling of air by evaporation of rain; frictional drag of falling rain is only appreciable with rain exceeding 25 mm. per hour (frequent in tropics); Buell's estimates (1945) are regarded as too high. *Subject Headings:* **Aeronautical meteorology, Rain squalls.**

3–108 551.577.5:551.577.21(423.8)

Balchin, W. G. V., and Pye, Norman. **Local rainfall variations in Bath and the surrounding district.** Royal Meteorological Society, Quarterly Journal, 74(321–322):361–378, July–Oct. **1948.** 13 figs., 2 tables, 9 refs. Summary p. 361. **DWB**—The first paper presents the details of the observational program of microclimatological investigations made in a 20 square mile area of the Cotswolds, where the river Avon cuts sharply into the surrounding hilly country. Daily readings were made by cooperative observers at 27 carefully located stations, during the period of 15 months from Oct. 1944 to Jan. 1946. In the second paper the rainfall variations under varying condition of wind directions and speeds are discussed and the data given in tables and on charts for individual storms with isolines drawn to enable comparison with a topographic chart. Variations in monthly means are also discussed and illustrated, showing the importance of exposure, altitude and air flow, and the marked variations in rainfall which can occur in short distances even with ideal exposures. Not so much variation occurs in number of rainy days as in total rainfall. *Subject Headings:* **Rainfall variations, Bath, England.**—*M.R.*

3–109 551.578.11

Best, A. C., **The size distribution of raindrops.** Royal Meteorological Society, Quarterly Journal, 76(327):16–36, Jan. **1950.** 3 figs., 11 tables, 11 refs., 22 equations. Summary p. 16. **DWB**—Using filter paper measurements at three stations in Britain and data by other workers, fraction F of liquid water in air, made up of drops of diameter less than x mm., is given by

$$1-F=\exp[-(x/a)^n]$$

where $a=1.30I^p$ [$I$ = rate of rain in mm./hr.]; n is variable, mean 2.25, maximum observed 6.1 in heavy showers. Weight W of water per unit volume of air = about $67I^{0.826}$. Tables are given of W and of number and total volume of drops of diameter (0–0.25) to (7.0–7.25) mm. for rainfalls of 0.5 to 25 mm./hr. *Subject Heading:* **Raindrop size distribution.**

3–110 551.578.1:621.396.9

Whalley, H., and Scoles, C. J., **Radar observation of heavy rain.** Nature, [London], 163(4140):372, March 5, **1949.** 5 figs. **DLC**—Description and illustration of belt of rain 50 miles wide passing over Manchester, Nov. 19, 1948. (P.M.) *Subject Headings:* **Rain, Radar storm detection.**

3–111 551.578.11:551.508.29

Byers, Horace R., Moses, Harry, and Harney, Patrick J., **Measurement of rain temperature.** Journal of Meteorology, 6(1):51–55, Feb. **1949.** 8 figs., 7 refs. Abstract p. 51. **DWB**—Description of instrument used in measuring difference between rain and ambient air temperatures, and methods of calibrating equipment. Three types of curves result from measurements made during storms in Ohio: (1) a sharp drop in both air and rain temperature soon after rain begins but with greatest difference five minutes after onset (thunderstorm type), (2) tremendous difference a minute after onset (hail type), rapidly equalizing, and (3) slight variations of one curve from the other when air is initially cool and saturated. *Subject Headings:* **Rain temperature measurements, Thermometers.**—*M.R.*

3–112 551.578.11

Langille, R. C., and Gunn, K. L. S., **Quantitative analysis of vertical structure in precipitation.** Journal of Meteorology, 5(6):301–304, Dec. **1948.** 3 figs., 2 refs., 4 equations. **DWB**—Summary of experiments made in Canada on determination of the structure, the internal motion and development of six showers. HPI equipment described and theory presented as well as photographs of HPI scope and reconstruction of structure of showers. *Subject Headings:* **Rain structure, Radar meteorology.**—*M.R.*

## HYDROMETEOROLOGY

3–113 551.579(02)

Linsley, Ray K. Jr., Kohler, Max A., and Paulhus, Joseph L. H., **Applied hydrology.** New York, Toronto, London, McGraw-Hill, **1949.** 689 p., figs., charts, tables, refs. in footnotes, append., bibliog. p. 662–663. **DWB**—The book is intended for practicing and student hydrologists and hydrologic engineers, including between one set of covers much material otherwise available only in periodical literature or in reports of limited circulation. Its prime purpose is to present, after development from basic principles, the latest methods for the forecasting of streamflow and water supply. It includes a short summary of basic theoretical meteorology for hydrologists but its stress on data and practices common to both fields makes it of interest to meteorologists. It contains an unusual collection of maximum observed rainfall intensities, both point and areal, and also estimates of "maximum possible" precipitation for areas from ten to 500 square miles. Detailed instructions (as developed by the Corps of Engineers) are given for the time-area-depth analysis of storm rainfall. The theory and practice of the "hydrometeorological" extrapolation of observed storm rainfall to maximum possible estimates for design purposes are discussed, as are the uses and theories of intensity-frequency analysis of floods and rainfalls. Double-mass-curve and graphical-multiple correlation methods of analysis of rainfall-runoff relations are illustrated with examples from actual practice. The relations between type of storm rainfall, basin character, and shape of hydrograph are examined in great detail and illustrated. There is much material, both theoretical

and empirical, on the physics and computation of snow melt and evaporation. The citation of references is thorough and an appendix listing the sources of hydrologic and meteorological data is included. *Subject Headings:* **Hydrology, Hydrometeorology, Textbooks.**—*A. L. Shands.*

3–114 551.579(02)

Johnstone, Don, and Cross, William P., **Elements of applied hydrology.** New York, Ronald Press, [1949]. 276 p., numerous figs., tables, refs., and equations. **DLC**—Brief but up-to-date treatment of the usual elements taken up in a course in hydrology with particular application to the U.S.A.: the hydrologic cycle, collection and analysis of precipitation and run-off data, the effect of snow cover, land characteristics, percolation, and size and shape of drainage basins. A chapter at the end is devoted to the application of statistics to hydrology, including examples of frequency studies, correlation, determination of sampling error and tests of significance. The chapter on collection of precipitation data goes rather fully into time-series, storm studies, snow surveys, point rainfall, isohyetal charts and intensity-duration frequencies, with examples from the Muskingum (Ohio) studies. Precipitation-runoff relations, the unit hydrograph and their applications are also treated adequately. *Subject Headings:* **Hydrology Textbooks.**—*M.R.*

3–115 551.579(714)

*Parde, Maurice, **Hydrologie du Saint-Laurent et de ses affluents.** [Hydrology of the St. Lawrence and its tributaries.] Revue Canadienne de Géographie, 2(2-3-4):35–83, Sept.–Dec. **1948.** 11 figs., 11 tables, refs. **DA**—Comprehensive study of streams, rivers, lakes, basins, soil and vegetation, climate (snow), seasonal variation, run-off, floods, etc., of various tributaries and main body of St. Lawrence. Comparison with rivers of U.S.S.R. (Volga, etc.). *Subject Headings:* **Hydrology, Quebec.**—*M.R.*

## CLIMATOLOGY AND BIOCLIMATOLOGY

### CLIMATOLOGY

3–116 551.58(57)

*Fedorov, N. S., **K kharakteristike klimata Krasnoiarskogo okruga Sibraia.** [On the characteristics of the climate of the Krasnoiarsk region of Siberia.] Otdelyi Ottisk iz Izvestii Srednesibirsk Otdela Gosudarstv. Russkogo Geografich. Ob-va. **1928**g. Tom 3(3), Krasnoiarsk. 36 p. **NNA**—This study of the climate of central Siberia (54°–73°N and 50° to 70°E) comprises a discussion of the surface temperature and precipitation in various aspects: averages, extremes and variations over the entire period of record (1838–1926 for Krasnoiarsk). A large portion of the work is devoted to annual and decadal values for the opening and closing of the Eniseia for the period 1779–1927, and comments on various unusual years in history. An attempt is made to show some rhythm or trend in the long term averages. Phenological data are also given and discussed. A table gives the location of 33 meteorological stations in or near the region, and the period of record for each. *Subject Headings:* **Climatology, Krasnoiarsk, U.S.S.R., Siberia.**—*M.R.*

3–117 551.582(263)(66)(673)

*Great Britain Meteorological Office, **Weather on the west coast of tropical Africa from 20°N. to 20°S., including the Atlantic Ocean to 25°W.** London, H. M. Stationery Office, **1949.** 281 p., 71 figs., plate, 14 climatic tables, numerous small tables in text, bibliog. (139 items classified), subject and geographical indexes. At head of title: M. O. 492. **DWB**—A detailed, well documented treatise. Gives general climatic features, summaries of seven regions, annual and diurnal variations of weather types and climatic elements. Also includes upper winds, temperature and humidity in free air (illustrated by tephigrams); 118 pages of tables include full monthly summaries for 30 stations and numerous tables of wind, visibility, etc. *Subject Headings:* **Climatology, Tropical West Africa.**

3–118 551.582:551.509.34(798)

*§U. S. Army Air Forces, Weather Central, 11th. Weather Region. **Report on Elmendorf (Alaska) weather.** Jan. 20, **1946.** 38 p., figs., charts, tables. **DAWS**—Climatology of

region around Elmendorf Field (Anchorage), Alaska for the use of the forecaster or pilot: precipitation, fog, winds, etc., with seven synoptic series representing case histories of various adverse weather types. Detailed statistical and graphic representation of precipitation, fog and strong winds with various air-flow types. Ample use made of hourly sequences, upper air soundings, etc., and of duration frequency data. One of the better local weather studies. *Subject Headings:* **Climatology, Alaska.**—*M.R.*

3–119 551.582.2(71)

*Canada, Dept. of Transport, Meteorological Div., **Meteorological conditions at selected airports in Canada, Newfoundland and Labrador.** Toronto, [1947]. **DWB**—Thirty sheets of monthly tabular data on pressure, temperature, relative humidity, wind, cloud cover, sunshine, rain, snow, weather, visibility and flight conditions; and accompanying charts showing station location, surroundings, and important weather factors with various types of air-flow toward station. Complete revision of publication dated 1944 with same title. Used in fulfillment of ICAO commitments of 1946. *Subject Headings:* **Climatology, Observational data, Canada.**—*M.R.*

3–120 551.582(548)(694)(699)

*Newnham, E. V., **The climates of Addu Atoll, Agalega Islands and Tristan da Cunha.** London, H. M. Stationery Office, **1949.** 20 p., 4 photos, 5 maps, 22 tables. ([Great Britain] Meteorological Office. Professional Notes, No. 101.) At head of title: M. O. 524a. **DWB**—Gives detailed climatic summaries and discussion of observations at Addu Atoll (0°41′S, 73°10′E, 1942–1945), Agalega Islands (10°30′S, 56°40′E, 1945–1947) and Tristan da Cunha (37°3′S, 12°19′W, 1942–1944). Upper winds (pilot balloon) are given for Addu Atoll, and mean hourly pressure, temperature, R. H. and sunshine for each month at Tristan. *Subject Headings:* **Climatology, Addu Atoll, Agalega Islands, Tristan da Cunha.**

## CLIMATIC CHANGES

3–121 551.58(09)

†Brooks, C. E. P., **Climate through the ages; a study of the climatic factors and their variations.** New York, Toronto, McGraw-Hill, **1949.** 2nd ed., completely rev. 395 p., 39 figs., 31 tables, references at end of chapters, equations, 2 append. **MH-BH**—The first edition of this book, published in 1926, comprised a review of many of the important theories of geological and historical climates and climatic changes, based on 20 years of intensive study in this field. Much additional evidence for or against these theories accumulated during the subsequent 20 years, so the second edition, finished in 1947 and published in 1949, represented a much more mature judgment of this extremely important subject. Critical examination of much of the data taken from chronicles and literature led to their being rejected, and deleted from the text of the second edition.

Part I consists of a discussion of the various climatic elements and their variation: pressure and winds, oceanic circulation, solar radiation, cloudiness, continentality, temperature, precipitation (rain and snow), etc., including treatment of the effect of glaciers and lack of glaciers on climate, and the effect of mountain building, astronomical factors, etc. on glaciation and deglaciation.

In Part II, entitled **Geological Climates and Their Causes,** there is a thorough review of the geography and climate of the various geological eras, and a critical examination of the theory of continental drift. In Part III the more plausible evidence of climatic fluctuations in the historical past is reviewed, with citations from recent literature on the subject, and arranged by continents: Europe, Asia, Africa, America and Greenland. The **appendix** contains, in addition to a discussion of the geological time-scale, a selective bibliography on various theories of climatic change, based on the following schools of thought: I. Cosmical Changes, II. Solar Radiation, III. Astronomical, IV. Earth Heat, V. Pole Movements or Drift of Crust, VI. Elevation, VII. Land and Sea Distribution, VIII. Ocean Currents, IX. Changes in Atmospheric Composition, X. Volcanic Dust and XI. Changes of Atmospheric Circulation. All of these theories are discussed in the text enabling the reader to better evaluate such evidence as exists for theories of continental or polar drift, glaciation or deglaciation, elevation of land

masses, shrinking of lakes and seas or of ice in the Arctic. One is also given a better perspective of the statistical value of tree-ring, pollen, varve, and other methods of geochronology. *Subject Headings:* **Climatic variations, Paleoclimatology, Historical climate.**—*M.R.*

3–122 551.583.2:551.586:551.588

†Berg, L. S., **Klimat i zhizn'.** [Climate and life.] 2nd rev. and enl. ed. OGIZ, Moscow, **1947.** 356 p., figs., tables, refs. Author and subject index. **DLC**—Recent changes in climate: warming in Arctic, recession of border of permafrost, warming in middle latitudes, in mountains, in Gulf Stream, decrease in continentality. Changes in historical times: moisture in atmosphere and soil, shrinking of lakes, decrease in river run-off, changes in vegetative cover, soil changes, deserts; changes in central Asia and Siberia and abroad; in the level of the Caspian and in navigation conditions in Arctic. Desiccation in latest epoch. Changes in relief accompanying drying out of last era. Changes in biological distribution in sub-Arctic regions. Changes in sea-life in Northern Hemisphere. Bipolar distribution of organisms in connection with glacial period. Loess as a product of increase in wind and soil formation processes. Climate of geological eras. Life and soil changes in heart of continent: pioneer life and paleontological data on ancient life. Completely annotated with index of Latin names of plant and animal species and authors referred to in text; extensive bibliographies at end of each chapter, and index of subjects and geographical names. Chapter on loess is very comprehensive. *Subject Headings:* **Paleoclimatology, Climatic variations, Bioclimatology.**—*M.R.*

3–123 551.583.2:551.311.12(04)

Miller, Maynard M., **The vanishing glaciers.** Science Illustrated, 4(3):21–27, March **1949.** illus. **DWB**—Popular article about expedition to investigate Canadian and Alaskan glaciers. It was found that while many glaciers are receding rapidly, Taku Glacier near Juneau has been advancing for 50 years. Muir Glacier has fallen back 2½ miles in last 10 years. *Subject Headings:* **Climatic variations, Glaciers, Alaska.**—*M.R.*

3–124 551.583.3

Sauer, Carl O., **The last deglaciation.** American Philosophical Society, Proceedings, 92(1):65–77, March 8, **1948.** fig., refs. **DWB**—Contains discussion of late glacial and pluvial climates, eustatic rise of sea level, and climatic and vegetation changes in North America during deglaciation. Maintains that no change in climate is necessary during entire course of deglaciation —only at beginning and end. *Subject Headings:* **Climatic variations, Glacial periods.**—*M.R.*

## APPLIED CLIMATOLOGY

3–125 551.586:551.582:656.7(8)

*§Great Britain Meteorological Office, **Aviation meteorology of South America.** London, H. M. Stationery Office, **1948.** 50 p., 20 figs., 4 tables, 13 refs., 4 append. ([Great Britain] Meteorological Office, Meteorological Reports, No. 1.) At head of title: M. O. 496a. **DWB**—A general treatment of flying weather in South America from the synoptic point of view. Discussion of general circulation, air masses, seasonal differences in various sections of South America. Special consideration of Montevideo–Santiago airports. Tables of surface and upper air data for major airports along the route. (Montevideo, Buenos Aires, Paraná, Mendoza, Santiago and Valparaíso.) Ceiling and visibility data. Synoptic charts for two series as affecting Montevideo–Santiago air route. Map of South America shows main airports. *Subject Headings:* **Aeronautical meteorology, Airports, South America.**—*M.R.*

3–126 551.586:57

Petersen, William F., **Man. Weather. Sun.** Springfield, Illinois, Charles C. Thomas, **1947.** 463 p., 294 figs., 24 tables, refs. **DWB**—The first part is an analysis of effects of weather changes on each of three triplets taken from elaborate and carefully executed observations and tests made daily, and analyzed statistically. Effect on metabolism, blood, oxygen, moods, and mental reactions considered. The second part discusses reaction on population: insanity, births, deaths, suicides, sex-ratio, and twinning. The third part, diseases and cycles in relation to astronomical cycles, conceptions, genius. Appendix contains discussion of methods, a subject index, author index, illustration index and observations on each of the triplets. *Subject Headings:* **Bioclimatology, Medical meteorology.**—*M.R.*

3–127 551.586:92

Philipsborn, Ernst von, **Gottfried Wilhelm von Leibniz** [*Sic*] **und die Bioklimatologie.** [Gottfried Wilhelm von Leibnitz and bioclimatology.] Meteorologische Rundschau, 2(5–6):177–178, May–June **1949.** 4 refs. **DWB** *Subject Headings:* **Bioclimatology, Biography, Von Leibnitz, Gotffried Wilhelm.**

3–128 551.501.4:551.525.2:551.586:63

Geiger, Rudolf, **Wärmehausaltskonstanten für den Agrarmeteorologen.** [Heat exchange constants for agricultural meteorology.] Meteorologische Rundschau, 1(11–12):322, May–June **1948.** table. **DWB**—Brief test and table of conductivity, specific heat, for different types of soil or ground cover. *Subject Headings:* **Methods of computation, Agricultural meteorology, Heat exchange, Ground temperature.**

3–129 551.586:61

Butson, A. R. C., **Acclimatization to cold in the Antarctic.** Nature, [London], 163(4134):132–133, Jan. 22, **1949.** 11 refs. **DWB**—Tests on basic metabolism, blood-sugar level, sensitivity to adrenalin and capacity to work with exposed hands, made during a year in the Marguerite Bay area. Clothing requirements not more than in winter in England. Difference between American and British metabolism. *Subject Headings:* **Bioclimatology, Medical meteorology, Antarctic.**

3–130 551.586.61

Glickman, Nathaniel, **Comparison of physiological adjustments of human beings during summer and winter.** Heating, Piping and Air Conditioning, 20(8):113–119, Aug. **1948.** 5 figs., table, 11 refs. **DWB**—Results of research sponsored by ASHVE in cooperation with University of Illinois College of Medicine. The tests described are studies on the rapidity and magnitude of physiological adjustments made by the body, at rest, on exposure to sudden changes of environmental temperature and humidity during the winter. Comparisons are made with similar tests made in summer. Four healthy male medical students from 19 to 23 years in age were used as subjects, three being the same as were used in summer tests. After one hour exposure to a comfortable environment, reactions were the same in summer and winter. The comfort impression on entering a comfortable room was higher in winter than in summer. After one hour in a hot room, mean skin temperature was the same in winter and summer, but rectal temperatures increased slightly more in winter. Perspiration was greater in summer, although the time of appearance on the subject was the same. *Subject Headings:* **Bioclimatology, Medical meteorology.** *Author's abstract.*

3–131 551.586:62:551.525.5:69(798)

Spofford, C. M., **Low temperatures in inaccessible Arctic influence construction costs.** Civil Engineering, 19(1):24–26, Jan. **1949.** illus. **DWB**—Climatic conditions in various parts of Alaska given, along with frozen soil information, as affecting surveying, building construction and other engineering problems. *Subject Headings:* **Frozen soil, Applied climatology, Alaska.**—*M.R.*

3–132 551.586:63

Franc de Ferrière, P. J. J., Grencier de Ruère, Jean, and Simeon, Sylvain, **Influence du climat et du sol sur l'alimentation phosphatée de la vigne sous climat Atlantique.** [Influence of climate and soil on the assimilation of phosphate by grapes in the Atlantic climate.] Académie des Sciences, Paris, Comptes Rendus, 228(17):1376–1378, April 25, **1949.** 2 figs., table, refs. **DWB**—Analysis of $P_2O_5$ assimilated in 1947 (dry year) and 1948 (humid year). *Subject Headings:* **Bioclimatology, Agricultural meteorology.**

3–133 551.586:67:551.5:67

Bates, C. C., and Glenn, A. H., **Meteorological engineering and the oil industry.** Oil Weekly, 125(12 & 13):33–34, May 19, **1947,** and 42–46 and 52, May 26, **1947.** 14 figs., table. **DWB**—Application of experience gained during the war in meteorology, hydrology, oceanography and soil mechanics to solution of problems confronting the oil industry. Exploration

by ground, in shallow waters, or by air requires knowledge of climate, wave conditions, flying conditions, visibility, cloudiness, temperature, frosts, soil trafficability, humidity, surface winds and precipitation. For long range planning frequencies of climatic elements enable estimates to be made of the success of operations in any season or place, thus concentrating efforts where the most effective use can be made at that season. For immediate operations the synoptic forecast (for soil, flying or wave-surf conditions) will increase efficiency. Many examples given, charts and graphs taken from Air Weather Service and Hydrographic Office Reports, illustrate methods of presentation for many elements and many parts of the earth. *Subject Headings:* **Applied climatology, Meteorological engineering.**—*M.R.*

3–134 551.586:697

[Avery, Lester T.], **Suggests we abandon "comfort" and air condition for health.** Heating, Piping and Air Conditioning, 19(12):106–107, Dec. **1947.** fig. **DWB**—Discusses the subject of the proper temperatures and humidites for winter and summer air conditioning. Comfort lines meaningless, considering effect of panel cooling of cold surfaces, warmth from ceiling heated by strong lights, sunshine or convectively raised hot air. ASHVE Comfort Chart for still air in error if "healthful" conditions are to be considered. Recent data secured by Army and Navy should be used even if it contradicts older ideas. *Subject Headings:* **Applied climatology, Air conditioning.**—*M.R.*

## MISCELLANEOUS PHENOMENA

### OPTICAL PHENOMENA

3–135 551.593.5:535.34

Barber, D. R., **The effect on observations of the sky/sea brightness ratio produced by the use of colour filters and Polaroid screens.** Royal Meteorological Society, Quarterly Journal, 76(327):95–98, Jan. **1950.** plate (6 photos), 3 tables. Summary p. 95. **DWB**—Brightness contrast of sky-sea horizon is increased by red and yellow filters, especially in haze or light mist. Contrast is increased by a polarizing filter with overcast sky and mist but depends also on other factors. Anomalous polarization is often observed during early twilight along antisolar path, due to earth's shadow. *Subject Headings:* **Optical phenomena, Absorption, Polarization.**

3–136 551.593.5:523

Underhill, Anne B., **Absorption lines formed in a moving atmosphere.** Astrophysical Journal, 106(1):128–134, July **1947.** 2 figs., 11 refs., 21 equations. Abstract p. 128. **DLC**—Theoretical treatment of subject based on Chandrasekhar's theory for transfer of radiation through a model atmosphere, and applied to a uniformly expanding atmosphere. Results in accord with work of O. C. Wilson were obtained. Effects of rotation, expansion or turbulence on width of lines treated. *Subject Headings:* **Absorption, Stellar atmospheres.**

3–137 551.593.63

Küttner, Joachim, and Model, Ernst, **Nebenuntersonne, Unterjupiter und andere bemerkenswerte Halo-Beobachtungen auf der Zugspitze.** [Mock-sun and mock-jupiter, and other noteworthy halo-observations on Zugspitze.] Meteorologische Rundschau, 1(7–8):218–220, Jan.–Feb. **1948.** 4 figs., 12 refs. **DLC**—Numerous carefully recorded and illustrated observations of optical phenomena made between November 1945 and February 1948. *Subject Heading:* **Halo observations.**

3–138 551.593.653(09)

Scultetus, H. R., **Ältere Beobachtungen von Leuchtstreifen.** [Early observations of luminous streaks.] Zeitschrift für Meteorologie, 3(8–9):272, Aug.–Sept. **1949. DWB**—*Subject Headings:* **Noctilucent clouds, History.**

3–139 551.593.653

†Spangenberg, Wolf W., **Über die leuchtenden Nachtwolken der Jahre 1932 bis 1941.** [On the luminous night clouds of the years 1932–1941.] Wetter und Klima, 2(1–2):15–23, Jan.–Feb. **1949.** 2 figs., 3 tables, 25 refs. **DWB**—Of 42 observations, 23 were in 1933 and 1934

following eruption of Quizapu on April 10, 1932, followed by a progressive decrease. But they are most frequent in July (after solstice) suggesting an extra-terrestrial effect. Direction of travel in most cases from east to northeast (compare meteor trails). *Subject Heading:* **Noctilucent clouds.**—*C.E.P.B.*

3–140 551.593.653

†Paton, J., **Luminous night clouds.** Meteorological Magazine, [London], 78(930):354–357, Dec. 1949. fig., 2 photos, 10 refs. **DWB**—Observed from Scotland July 10–11, 1949. Height ca. 89 km. Historical account given. *Subject Heading:* **Noctilucent clouds.**

## ELECTRICAL PHENOMENA

3–141 551.594.12:551.510.53

Falckenberg, G., and Lauter, E., **Die Ionisation der Stratosphäre über troposphärischen Hoch- und Tiefdruck-Gebieten.** [The ionization of the stratosphere above tropospheric high and low pressure regions.] Zeitschrift für Meteorologie, 3(5–6):136–140, May–June 1949. 7 figs. **DWB**—The absorption in the ionized stratosphere of the space wave of 1,250 m. broadcast from Kalundborg and reflected by the E-layer was studied on 650 nights by noting the percentage of time that it fell below a given ratio to ground wave. Frequency distribution shows two peaks at 50 and 15%, and is resolved into two Gaussian curves and a remainder. Relation to tropospheric lows (great absorption) and stratospheric highs (small absorption) is compared to broad-weather situation and tendency of 500 mb. surface. Remainder represents periods of great absorption which may be due to extra-terrestrial influences or magnetic disturbance. *Subject Headings:* **Ionization, Stratosphere.**—*C.E.P.B.*

3–142 551.594.13:551.591

Kilinski, Erich von, **Über den Einfluss meteorologischer Faktoren auf die atmosphärische Leitfähigkeit.** [On the influence of meteorological factors on atmospheric conductivity.] Zeitschrift für Meteorologie, 3(1–2):46–49, Jan.–Feb. 1949. 3 figs., table, 4 refs. Summary in German p. 46. **DWB**—Electrical conductivity increases with visibility up to 29 km., then constant. It decreases with increasing relative humidity, especially near saturation; in both these relations ion adsorption plays an important part. Conductivity increases with temperature up to 20–30°C. because of increased release of air from soil; a possible decrease above 30° may be due to vertical currents. *Subject Headings:* **Atmospheric conductivity, Visibility.**—*C.E.P.B.*

3–143 551.594.2

†Simpson, George, **Atmospheric electricity during disturbed weather.** London, H. M. Stationery Office, 1949. 51 p., 8 figs., 18 plates, 7 tables, 18 refs., 13 equations. ([Great Britain] Meteorological Office. Geophysical Memoirs, No. 84.) At heat of title: M. O. 499d. **DWB**—Investigation at Kew Observatory. Disturbances of potential gradient are related to ascending currents in upper atmosphere; they are usually irregular but sometimes form regular oscillations (cause unknown). When gradient exceeds $|20|$ v./cm., charge on rain or snow is proportional to gradient but of opposite sign. Author suggests that charge on precipitation is mainly derived from point-discharge currents, partly by sweeping up ions (C. T. R. Wilson). With potential gradients negative, less than $|10|$ v./cm. (normal fine weather gradient at Kew 3–4 v./cm.) charge on rain is + and proportional to depression below normal. Charge on snow is −, gradient normal. *Subject Heading:* **Electricity of disturbed weather.**

3–144 551.594.223

Rossmann, F., **Über den Kugelblitz.** [On ball lightning.] Wetter und Klima, 2(3–4):75–81, March–April 1949. 4 refs. **DWB**—Describes occurrence and appearance of ball lightning; most frequent with dust storms, especially volcanic. Stationary balls appear on sharp conductors and are extreme examples of St. Elmo's fire. Moving balls are discharges from a dense collection of graupel or hailstones; near ground often dense whirled-up dust clouds, e.g., in subtropics. Ball lightning in closed rooms follows penetration of a flash, which raises a cloud of charged dust from stove or hearth. *Subject Heading:* **Ball lightning.**—*C.E.P.B.*

3–145 551.594.6

Norinder, Harald, **On the measurement and nature of atmospherics produced by electric discharges in snow squalls and from other sources.** Tellus, 1(2):1–13, May 1949. 19 figs., 2 tables, 12 refs., 7 equations. Abstract in English p. 1. **DWB**—The intense electric fields generated in snow squalls and clouds from which snow is falling, produce disruptive discharges, which though less intense and of shorter spark length than lightning discharges, are capable of producing atmospherics which may be measured by means of cathode ray oscillographs. Such oscillograms have a characteristic variation-pattern that is distinct from those produced by lightning discharges. Theoretical discussion of genesis of atmospherics in snow clouds, principles and methods of measuring atmospherics, with equipment and resulting oscillograms reproduced in illustrations. Detailed discussion and illustrations of an actual case of snow-squall clouds over Baltic near Institute at Uppsala. *Subject Headings:* **Sferics, Electricity of disturbed weather.**—*M.R.*

# PART II. SELECTIVE ANNOTATED BIBLIOGRAPHY ON CLOUD PHYSICS AND "RAIN MAKING"

By: *Harris P. Kramer and Malcolm Rigby*

## INTRODUCTION

This bibliography consists of two parts: (1) about a hundred selected references on the scientific or theoretical aspects of cloud physics and precipitation formation, and (2) about a hundred items on the artificial stimulation of precipitation (in popular language "rain making").

The references in each of the two above named sections are arranged chronologically in order to give the reader a perspective of the evolution of these two widely separated currents of investigation, and of their gradual merging during the past twenty years, until during the last four years (1946–1950) it is impossible to distinguish the theoretical research on the one hand, from the applied investigations on the other.

Attempts to control the weather through cloud-shooting, setting fire to the prairies (about 1850), dropping various substances into clouds (electrified sand, soap flakes, and dozens of different chemical compounds), and attempts to cool the saturated air in clouds by using liquid air or carbon dioxide were made during the past century.

But it was not until the knowledge of cloud physics had developed to the point where the highly unstable colloidal nature of supercooled or supersaturated clouds was understood, that experiments at rain-making or cloud dissipation began to appear fruitful. Even then it took 20 years for the technologists to catch up with the scientists and vice-versa.

The most successful attempts at rain-making by cloud seeding, prior to 1946, were conducted by the Hollander, Veraart ca. 1930 (see items C–109 to C–116), but unfortunately all of his work was published in Dutch, and in publications which did not receive wide distribution outside Holland. His work was officially squelched in the Netherlands because he made extravagant claims that shed doubt in scientific circles on the validity of his results. Confirmation of his success by those who observed the experiments, and by the press, did not bring recognition until long after his death. From all of this controversy and slowness to grasp the significance of such experiments, where someone attempts to apply insufficient knowledge of two different fields and hence is discredited even if successful (especially in his own country), we can draw at least two inferences which have bearing on the compilation and publishing of abstracts and bibliographies:

(1) No scientist can afford to overlook the work of any other scientist in his field, no matter what obscure language it be published in, or how seemingly unrelated the publication be.
(2) No scientist can afford to ignore the work of any other investigator, no matter how seemingly unorthodox or unscientific the approach. For those who value their scientific reputations too highly seldom venture into untried fields, and on the other hand those who do attempt to explore new fields are bound to make errors which bring on them the scorn of the more conservative.

The above comments are made in justification of the inclusion of a great deal of popular or semi-scientific material in these bibliographies.

Scientific aspects of cloud physics have been discussed in the literature from as early as 1710, when J. Boecler investigated the physics of rain and wrote his **Dissertatio Physica Pluviae** (published in Latin), down to the classic papers of Bergeron and Köhler, Findeisen, Weickmann, Schaefer, Langmuir and others of the past three decades.

The inclusion of a paper in the first or second section of this bibliography is purely arbitrary and it is hoped that no offense will be taken by any author at having his work classified as "theoretical" or "practical" when most papers contain some ingredients of both.

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# PHYSICS OF PRECIPITATION FORMATION AND CONDENSATION

1895–1929

**C–1** 551.577.1

McAdie, Alexander, **Natural rain-makers.** Popular Science Monthly, 47:642–648, Sept. **1895.** 3 photos. **DLC**—Reprinted in **Alexander McAdie, scientist and writer;** a volume containing fifty-four articles and essays by Alexander McAdie, letters, a short memoir and bibliography, and lists of books and instruments. Charlottesville, Virginia, **1949. MH-BH**—It is stated that in regards to a supercooled cloud "a snowflake or ice crystal falling into it may suffice to start a sudden congelation, just as we may see ice needles dart in all directions when the chilled surface of a still pond is disturbed. We liken this monstrous cloud to a huge gun, loaded and quiet, but with a trigger so delicately set that a falling snowflake would discharge it." *Subject Heading:* **Precipitation formation.**

C–2 551.578.1:551.576.11:551.574.1

[Abbe, Cleveland], **An experimental rainfall.** Monthly Weather Review, 24:373–374, Oct. **1896.** refs. **DLC**—Discussion and quotations from a letter printed in Ciel et Terre, 17:353, Aug. **1896,** by L. Errera. An experimental study of the formation of clouds using alcohol vapor is explained. Condensation on nuclei noted. It is said that after a certain critical stage of cooling is passed, "aqueous molecules begin to agglomerate without waiting for the presence of nuclei." *Subject Headings:* **Rain formation, Condensation nuclei.**

C–3 551.578.1:551.574.1

Wilson, C. T. R., **On the comparative efficiency as condensation nuclei of positively and negatively charged ions.** Royal Society of London, Philosophical Transactions, Ser. A., 193:289+, **1900.** 3 figs., tables, refs. **DLC**—Experiments conducted on relation between rain and atmospheric electricity. Attempt made to show that atmospheric air in regions in which rain formed is likely to contain free ions, and that positively and negatively charged ions differ in their efficiency as condensation nuclei. *Subject Headings:* **Atmospheric electricity, Condensation nuclei, Rain formation.**

C–4 551.578.41:551.574.1

Wegener, A., **Thermodynamik der Atmosphäre.** [Thermodynamics of the atmosphere.] Leipzig, **1911.** Kerne der Kristallbildung. [Nuclei of crystal formation.] p. 94–98. **DLC**—Observations of supercooled water drops. Question of formation of crystals presented. A. Wegener was the first to suggest that the coexistence of ice and water in supercooled clouds led to colloidal instability, resulting in rapid growth of solid water particles. *Subject Headings:* **Precipitation formation, Sublimation nuclei.**

C–5 551.577.1(481)

Bjerknes, J., and Solberg, H., **Meteorological conditions for the formation of rain.** Geofysiske Publikationer, 2, No. 3, **1921.** 45 figs., plate. **DLC**—Rain classified as cyclonic rain, instability showers, fog-rain (drizzle), orographical rain. It is stated that the properties of air in respect to stability and content of moisture are more important for the occurrence of local showers than the general distribution of pressure. Figures are mostly weather charts of Norway. *Subject Headings:* **Rain formation, Norway.**

C–6 551.576.11:551.574.1

Köhler, Hilding, **Zur Kondensation des Wasserdampfes in der Atmosphäre.** [Condensation of water vapor in the atmosphere.] Geofysiske Publikationer, 2, No. 1, **1921.** 15 p., fig., 2 tables, refs., 3 equations. **DLC**—The theory is presented that cloud drops develop on salt particle nuclei. *Subject Headings:* **Cloud formation, Condensation nuclei.**

C–7 551.576.11:551.574.1:551.575(91)

*Braak, C., **On cloud formation nuclei of condensation, haziness, dimensions of cloud-particles.** Koninklijk Magnetisch en Meteorologisch Observatorium te Batavia. Verhandelingen No. 10, **1922.** 3 p., numerous tables, refs., equations. **DWB**—Observations made in East Indies on number of nuclei of condensation found, using Aitken's dust counter. Variations with height, day and season were noted. Transformation of haze into fog, density of haze with relation to number of nuclei were discussed. Dimensions of cloud particles, factors determining size of hygroscopic particles, number of nuclei used for cloud formation, number of nuclei and density of haze and vertical distribution of nuclei during anticyclonic conditions were noted. *Subject Headings:* **Condensation nuclei, Cloud formation, East Indies.**

C–8 551.575.1:551.574.1

Owens, J. S., **Condensation of water from the air upon hygroscopic crystals.** Royal Society of London, Proceedings, Ser. A., 110:738–752, **1926.** 2 figs., 4 tables, ref. **DLC**—Experiments described on conditions of deliquescence of crystalline salts of air, having bearing on formation of haze, fog and condensation from the air. *Subject Headings:* **Fog formation, Condensation nuclei.**

C–9 551.578.41:532.77

Barnes, W. H., **The crystal structure of ice between 0°C. and −183°C.** Royal Society of London, Proceedings, Ser. A, 125:670–693, **1929.** 10 figs., 3 tables, refs., 6 equations. **DLC**—Detailed, mathematical study of structure of ice crystals. Number of molecules, geometrical structure, placing of hydrogen ions and arguments for ionic lattice, and complete structure for ice are discussed. Photographic proof is given that no change in structure of ice takes place between 0° and −183°C. *Subject Heading:* **Ice crystal formation.**

C–10 551.576.11:551.578.1

Köhler, Hilding, **Untersuchungen über die Wolkenbildung auf dem Pårtetjåkko im August 1928 nebst einer erweiterten Untersuchung der Tropfengruppen.** [Research on cloud formation on Pårtetjåkko August 1928, in addition to further research on drop grouping.] Naturwissenschaftliche Untersuchungen des Sarekgebirges in Schwedisch-Lappland. Band II. Meteorologie und Geophysik. Lief. 2:77–128, **1929.** figs., 6 tables, 13 refs., numerous equations. **DWB**—*Subject Headings:* **Cloud formation, Rain formation, Scandinavia.**

C–11 551.576.11:551.574.1

†Schmauss, August, and Wigand, Albert, **Die Atmosphäre als Kolloid.** [The atmosphere as a colloid.] Braunschweig, Verlag von Fried, **1929.** 74 p., 10 figs., 107 refs. **DWB**—It is shown that a cloud may be regarded as a colloidal suspension of water in air. Precipitation must be released by some processes capable of disturbing the colloidal stability of the cloud, and thus causing growth of hydrometeors large enough to fall from the cloud. *Subject Headings:* **Cloud structure, Condensation nuclei.**

## 1930–1939

C–12 551.578.41

Adams, J. M., **The origin of snowflakes.** Physical Review, 35(1):113–114, Jan. **1930. DLC**—Letter to the editor: This is significant early recognition of problem of studying crystal structure in the light of kinetic theory. It is shown that snowflakes grow at the expense of smaller ones; implied that equilibrium vapor pressure above a particle of ice decreases with increasing dimensions. *Subject Heading:* **Snow crystals.**

C–13 551.576.11

†Köhler, Hilding, **On water in the clouds.** Geofysiske Publikationer, 5, No. 1, **1930.** 16 p., 9 figs., 5 tables, 17 refs. **DLC**—Water content of clouds was measured and tabulated. Relations were developed between water content and distance of visibility and between drop size and water content. It is stated that droplets of larger sizes would freeze more readily than the smaller ones, and a critical size is postulated. *Subject Heading:* **Cloud structure.**

C–14 551.577.11:551.574.1

Melander, G., **Über die Entstehung der Regentropfen.** [On the formation of raindrops.] Beiträge zur Geophysik, 32:268–270, **1931.** ref. **DLC**—Observations and discussion of formation of water droplets in the air and the condensation nuclei on which they form. Water drops can also act as condensation nuclei. Speculation is made on the part of electric energy in precipitation formation. No data or conclusions. *Subject Headings:* **Precipitation formation, Condensation nuclei.**

C–15 551.578.41:551.574.1

Stüve, G., **Zur Kenntnis der Kristallisation des Wasserdampfes aus Luft.** [Information on crystallization of water vapor from the air.] Beiträge zur Geophysik, 32:326–335, **1931.** 6 figs., 2 tables, refs. Abstract in English. **DLC**—Effects of different hygroscopic nuclei for formation of precipitation are discussed by comparing snow and rime. Temperatures are determined in respect to condensation and crystal formation. *Subject Headings:* **Ice crystal formation, Condensation nuclei.**

C–16 551.576:551.577.11

Bergeron, Tor, **On the physics of cloud and precipitation.** International Geodetic and Geophysical Union, Fifth General Assembly, Lisbon. Verbal Proceedings, 2:156–175, **1933.** fig., 30 refs. Summary in French. Photostat copy. **DWB**—Historical introduction. Author lists conditions favorable for colloidal stability of a cloud mass. He examines effects of each of these conditions: electric charge, size of, temperature of, and motion of cloud elements. He says none of recognized factors of cloud coagulation represent the universal release of real precipitation, and then presents his ice crystal theory with explanations. He postulates that rain falls only from clouds containing both water drops and ice crystals. *Subject Headings:* **Cloud physics, Precipitation formation.**

C–17 551.576.11:551.574.1

Köhler, Hilding, **Über die Chlorverteilung und die Tropfengruppen im Nebel und über Farbenberechnung der Kränze im weissen Lichte nebst einigen kritischen Bemerkungen der Koagulationstheorien der Nebeltropfen.** [On chlorine distribution and the drop-grouping in fog and on the color calculation of the ring of white light along with some critical remarks on the coagulation theory of fog droplets.] Arkiv för Matematik, Astronomi och Fysik, Vol. 24 A No. 9, Stockholm, **1933.** 8 figs., 16 tables, 26 refs., equations. **DWB**—*Subject Headings:* **Cloud structure, Condensation nuclei.**

C–18 551.576.11

Douglas, C. K. M., **The physical processes of cloud formation.** Royal Meteorological Society, Quarterly Journal, 60:333–341, **1934.** refs. **DLC**—Author divides physics of clouds into two headings: one, concerned with actual cloud particles, size, composition, characteristics, etc.; and two, with which this paper is mainly concerned, the nature of the physical and dynamical processes leading to condensation, a problem which resolves itself mainly into a study of the various types of vertical motion in the atmosphere. *Subject Headings:* **Cloud formation, Cloud structure, Cloud physics.**

C–19 551.578.41

Nakaya, Ukitiro and Sato, Isonosuke, **On the artificial production of frost crystals with reference to the mechanism of formation of snow crystals.** Reprinted from the Journal of Faculty of Science, Hokkaido Imperial University, Ser. II, 1(7):206–214, Oct. **1935,** Japan. 17 figs., 2 tables, 7 refs. (Private library of Prof. William Houghton).—Experiments conducted to produce frost crystals. Crystal habits and degree of supersaturation discussed. Form of crystals, temperature of air where crystal is formed, and the supersaturation ratio, are tabulated. *Subject Heading:* **Snow crystals.**

C–20 551.574.1

Holzman, B., **A note on Bergeron's ice-nuclei hypothesis for the formation of rain.** American Meteorological Society, Bulletin, 17:331–333, Nov. **1936.** 7 refs. **DWB**—Discussion of Bergeron's theory that ice particles are the nuclei upon which condensation will occur in the formation of rain. It is concluded here that ice nuclei are not essential for the production of (even heavy) rain. *Subject Heading:* **Condensation nuclei.**

C–21 551.574.1:551.508.91

Junge, Chr., **Übersättigungsmessungen an atmosphärischen Kondensationskernen.** [Supersaturation measurement in relation to atmospheric condensation nuclei.] Beiträge zur Geophysik, 46:108–129, **1936.** 12 figs., 2 tables, 10 refs. **DLC**—Nuclei are produced by drawing air over the glowing filament of a Nernst lamp and by burning coal gas in a current of air. From the mobility of these ions formed, their size can be determined. Mobility of ions measured at a number of relative humidities; curves show relationships. Nature of nuclei is discussed; it is concluded that they are sulphuric acid formed from sulphur in the coal gas. Constancy of their size below 70% relative humidity thus not due to crystallization. *Subject Heading:* **Condensation nuclei.**

C–22 551.577.1:551.524.7

*Peppler, W., **Zur Aerologie der Wolken besonders des Nimbus.** [On aerology of clouds especially of nimbus.] Beiträge zur Physik der freien Atmosphäre, 23(4):275–288, **1936.** 11 tables, refs. **DLC**—Bergeron's theory of precipitation formation is presented. Peppler here attempts to determine temperatures in various cloud types on basis of aerological observations. Results tabulated. *Subject Heading:* **Precipitation formation.**

C–23 551.574.1

Wright, H. L., **The size of atmospheric nuclei: some deductions from measurements of the number of charged and uncharged nuclei at Kew Observatory.** Physical Society of London, Proceedings, 48:675–689, **1936. DLC**—The object of the paper is to set out formulas to be used in determining the size of condensation nuclei. (Corrected by G. C. Simpson, 1941.) *Subject Heading:* **Condensation nuclei.**

C–24 551.574.1

Findeisen, W., **Entstehen die Kondensationskerne an der Meeresoberfläche?** [Do condensation nuclei originate from the sea's surface?] Meteorologische Zeitschrift, 54(10):377–379, Oct. **1937.** 13 refs. **MH**—From author's abstract: Most condensation nuclei do not originate as salt particles from sea surf, but from the continent. *Subject Heading:* **Condensation nuclei.**

C–25 551.577.1

†Findeisen, W., **Die kolloidmeteorologischen Vorgänge bei der Niederschlagsbildung.** [Colloidal-meteorological processes in the formation of precipitation.] Meteorologische Zeitschrift, 55:121–133, April **1938.** 2 figs., 22 refs. **DWB**—Translated by A. R. Stickley, in **Selected papers on the physics of condensation and precipitation. DWB**—Translated by Moses Sharenow, Meteorological Branch, Evans Signal Laboratory, Belmar, New Jersey. Published by Signal Corps Engineering Laboratories, Bradley Beach, New Jersey. **NSGE** - Taken from author's abstract: Microphysical processes of formation of rain are discussed on the basis of new views on cohesion. All essential phenomena of the formation of precipitation are explained. Important new points of view result for practical meteorology. *Subject Heading:* **Precipitation formation.**

C–26 551.577.11

Findeisen, W., [Translated by A. R. Stickley.] **Selected papers on the physics of condensation and precipitation.** 40 p., 14 figs. Mimeographed. **DWB—I. The colloidal meteorological processes in the formation of precipitation.** p. 1–21, 22 refs. See idem. **C–25. II. Formation of rain clouds.** p. 24–34, 5 refs. Original in Zeitschrift für angewandte Meteorologie, 55(7):208–225, **1938. III. Meteorological-physical limitations of icing in the atmosphere.** p. 35–40. From reprint of a paper presented before the 1938 Hauptversammlung der Lilienthal-Gesellschaft für Luftfahrtforschung. *Subject Heading:* **Precipitation formation.**

C–27 551.578.41

Nakaya, Ukitiro, **Artificial snow.** Royal Meteorological Society, Quarterly Journal, 64(277):619–624, Oct. **1938.** 6 figs., 8 refs. **DWB**—Summary of some of the experiments that were treated in detail by Nakaya and others in Journal of Faculty of Science, Hokkaido Imperial University. Study of sublimation of snow crystals. *Subject Heading:* **Snow crystals.**

C–28 551.578.41

Nakaya, Ukitiro, et al., **Preliminary experiments on the artificial production of snow crystals. Investigations on snow, No. 10.** Reprinted from the Journal of Faculty of Science, Hokkaido Imperial University, Ser. II, 2(1):1–11, March **1938.** 4 figs., 4 plates, table, refs. **DLC**—Relations between form of crystal and conditions of its formation studied in detail. *Subject Heading:* **Snow crystals.**

C–29 551.578.41

Nakaya, Ukitiro, et al., **Further experiments on the artificial production of snow crystals. Investigations on snow No. 11.** Reprinted from the Journal of Faculty of Science, Hokkaido Imperial University, Ser. II, 2(1):13–57, March **1938.** 18 figs., 11 tables, refs. **DLC**—Change in form of snow crystal due to action of sublimation studied by use of artificial snow. Snow crystal development treated in detail. *Subject Heading:* **Snow crystals.**

C–30 551.574.1

Wegener, A. and K., [Translated by A. R. Stickley.] Excerpts from **Physik der Atmosphäre, System of condensation forms.** In **Selected papers on the physics of condensation and precipitation.** (1938) **DWB**—*Subject Heading:* **Condensation nuclei.**

C–31 551.576.11

Findeisen, W., **Das Verdampfen der Wolken- und Regentropfen.** [The evaporation of cloud- and raindrops.] Meteorologische Zeitschrift, 56:453–460, Dec. **1939.** 16 refs., 39 equations. **MH**—From author's abstract: Formulas are given for evaporation speed of clouds and raindrops, and thereby the time of evaporation and the drop trajectories are determined. Examples are demonstrated and meteorological applications are cited. *Subject Heading:* **Cloud dissipation.**

C–32 551.578.41

Findeisen, W., **Flugmeteorologische Schneebeobachtungen.** [Snow observations from an airplane.] Meteorologische Zeitschrift, 56:429, **1939. NSGE**—First form in which particles of ice originate in the atmosphere must be skeleton forms, and in newly formed ice clouds the well-known 22°C. halo, for instance, would not be visible for this reason. *Subject Heading:* **Ice crystal formation.**

C–33 551.578.1

Findeisen, W., **Zur Frage der Regentropfenbildung in reinen Wasserwolken.** [On the question of rain drop formation in pure water clouds.] Meteorologische Zeitschrift, 56:365–368, Oct. **1939.** fig., 6 refs., 13 equations. **MH**—From author's abstract: Theoretically, raindrops of normal size cannot originate through coagulation or condensation, although doubtless this contradicts actual observations. *Subject Heading:* **Rain formation.**

C–34 536.42(02):551.578.41:551.574.1

†*Volmer, Max, **Kinetik der Phasenbildung.** [Kinetics of phase changes.] Dresden, **1939.** 218 p., 61 figs., 15 tables, 132 refs., 68 equations. **DLC**—Quantitative theory developed to which Schaefer's experiments can be related, suggesting method of planting dry ice crystals in natural clouds. Formation of ice crystals at very low temperatures is discussed. *Subject Heading:* **Ice crystal formation.**

1940–1945

C–35 551.576:551.574.1

Coulomb, J. and Loisel, J., **La physique des nuages.** [The physics of clouds.] Paris, Albin Michel, **1940.** 286 p., 161 figs., refs. **DLC**—Chapter II. Condensation et Sublimation, p. 19–27. *Subject Headings:* **Cloud physics, Condensation nuclei, Sublimation nuclei.**

C–36 551.576.1

Findeisen, W., **Die Entstehung der 0° Isothermie und die Fraktocumulus-Bildung unter Nimbostratus.** [The formation of the 0° isothermal layer and fracto-cumulus under nimbostratus.] Meteorologische Zeitschrift, 57:49–54, Feb. **1940.** 5 figs., 2 refs., 11 equations. **DWB**—Translation by Arnold Glaser. 8 p. **DWB**—*Subject Headings:* **Cloud formation, Cloud structure.**

C–37 551.576:551.577.1:551.515.4

*Kähler, Karl Friedrich, **Wolken und Gewitter.** [Clouds and thunderstorms.] Leipzig, J. A. Barth, **1940.** 158 p., 26 figs., 13 tables, refs., equations. **DLC**—Section A discusses

shapes and forms of clouds. Section B is concerned with cloud physics, water droplets, ice crystals and snow, graupel and hail; formation of clouds, water vapor, condensation nuclei—etc., cloud physics. Section C deals with thunderstorms, atmospheric electricity, etc. *Subject Headings:* **Cloud physics, Precipitation formation, Thunderstorms, Atmospheric electricity.**

C–38 551.578.41:551.574.1

†Krastanow, L., **Über die Bildung der unterkuhlten Wassertropfen und der Eiskristalle in der freien Atmosphäre.** [Formation of supercooled water drops and ice crystals in the free atmosphere.] Meteorologische Zeitschrift, 57(10):357–371, **1940.** 3 figs., 22 refs., 3 equations. **MH**—Quantitative treatment of growth of supercooled water drops and ice crystals in the free atmosphere. Nuclei for sublimation are considered unnecessary. Ice crystals can form directly from water vapor. *Subject Headings:* **Ice crystal formation, Sublimation nuclei.**

C–39 551.577.11:551.574.1

*Mann, Gerhard, **Untersuchungen über die aerologischen Bedingungen für die Niederschlagsbildung in der Atmosphäre an Hand des Aufstiegsmaterials der Wetterflugstelle zu Königsberg/Pr.** [Research on aerological conditions necessary for formation of precipitation in the atmosphere, based upon airplane observations from the weather observatory at the airport in Konigsberg, Prussia.] Beiträge zur Physik der freien Atmosphäre, 26(3):121–151, **1940.** 10 figs., 28 tables, 9 refs. **DLC**—Comprehensive, analytical treatment supported by carefully selected observational material. Findeisen's theory of sublimation nuclei is supported. Extensive observations of clouds made. Author lists conditions on which amount of precipitation depends. *Subject Headings:* **Precipitation formation, Sublimation nuclei.**

C–40 551.577.11

†*Petterssen, Sverre, **Weather analysis and forecasting.** McGraw-Hill, **1940.** 505 p., 249 figs., 60 tables, 89 refs., equations. **DWB, DLC—Chapter I.** Conditions for precipitation are discussed. It is stated that at temperatures of about −20°C. very small temperature difference between adjacent cloud droplets is sufficient to cause a large vapor tension difference, and hence give rise to a rapid transfer of water from the warmer droplets to the colder droplets through the vapor. In clouds of such temperatures sufficient turbulence to bring together droplets of slightly different temperatures may reasonably be expected. *Subject Headings:* **Precipitation formation, Weather forecasting.**

C–41 551.576.11:551.574.1

Schumacher, C., **Beobachtung an einer Altokumulusdecke.** [Observations in an altocumulus layer.] Zeitschrift für angewandte Meteorologie, 57:214–220, **1940.** 5 photos (of clouds), 2 graphs. **DWB, MH**—*Subject Headings:* **Cloud structure, Sublimation nuclei.**

C–42 551.584.1:551.508.91

†*Köhler, Hilding, **An experimental investigation on sea water nuclei.** Regiae Societatis Scientiarum Upsaliensis, Nova Acta 12, No. 6, **1941.** 55 p., 10 figs., 26 tables, 28 refs., equations. **DLC**—Summary: By means of Millikan's method, mass, radius, density and concentrations of droplets driven from sea water have been measured. . . . Rate of evaporation was preliminarily investigated. *Subject Heading:* **Condensation nuclei.**

C–43 551.578.41:551.577.11:551.574.1

Krastanow, L., **Beitrag zur Theorie der Tropfen- und Kristallbildung in der Atmosphäre.** [Contribution to the theory of drop and crystal formation in the atmosphere.] Meteorologische Zeitschrift, 58(2):37–45, Feb. **1941. DWB, MH**—*Subject Headings:* **Rain formation, Ice crystal formation, Condensation nuclei.**

C–44 551.578.41

Regener, Erich, **Versuche über die Kondensation und Sublimation des Wasserdampfes bei tiefen Temperaturen.** [Research on condensation and sublimation of water vapor at low temperatures.] Deutsche Akademie der Luftfahrtforschung, Berlin, Schriften, 37:15–24,

**1941.** fig., refs. **DLC**—Behavior of supercooled water droplets in clouds and conditions under which ice crystals form are discussed. Volmer's theory of formation of ice crystals at very low temperature is supported. *Subject Heading:* **Ice crystal formation.**

**C–45** 551.576.1:551.577.11:551.574.1

Simpson, G. C., **On the formation of cloud and rain.** Royal Meteorological Society, Quarterly Journal, 67:99–133, April **1941.** 5 figs., 7 tables, 25 refs. **DWB**—Processes involved in formation of cloud and rain are described. Questions are posed on the part played by condensation and sublimation nuclei in the formation of cloud particles, rain drops, ice crystals, etc. *Subject Headings:* **Cloud formation, Precipitation formation, Sublimation nuclei, Condensation nuclei.**

**C–46** 551.574.1

Simpson, G. C., **Sea-salt and condensation nuclei.** Royal Meteorological Society, Quarterly Journal, 67:163–169, **1941.** 2 figs., equation. **DWB**—Author controverts opinion that nuclei on which cloud particles form are composed of sea-salt from sea-spray; gives background of theory; proves that hygroscopic nuclei in the atmosphere are not solutions of sea-salt or any other salt. *Subject Heading:* **Condensation nuclei.**

**C–47** 551.574.1:551.578.41

Findeisen, W., **Experimentelle Untersuchungen über die Eisteilchenbildung.** [Experimental research on ice particle formation.] Meteorologische Zeitschrift, 59:349–353, **1942.** 11 refs. **DWB, MH**—Discussion of sublimation nuclei and their effectiveness concerning the formation of atmospheric ice particles. *Subject Headings:* **Sublimation nuclei, Ice crystal formation.**

**C–48** 551.578.41:551.574.1

Wall, E., **Material zur Frage der Eiskeimbildung in der Atmosphäre.** [Material on the question of ice nuclei formation in the atmosphere.] Meteorologische Zeitschrift, 59(4):109–120, April **1942. DWB, MH**—*Subject Headings:* **Ice crystal formation, Sublimation nuclei.**

**C–49** 551.578.41

Wall, E., **Wo entstehen die Schneekristalle?** [Where do snow crystals originate?] Zeitschrift für angewandte Meteorologie, 59:301+, **1942. MH**—(Unchecked.) *Subject Heading:* **Snow crystals.**

**C–50** 551.574.1:551.578.41

†Weickmann, H., **Experimentelle Untersuchungen zur Bildung von Eis und Wasser an Keimen bei tiefen Temperaturen.** [Experimental investigations in formation of ice and water on nuclei at low temperatures. (Inferences regarding the growth of atmospheric ice crystals.)] Forschung Bericht No. 1730, Zentrale für wissenschaftliche Berichte der Luftfahrtforschung, Berlin-Adlershof, **1942.** (Original unchecked.) Translated by Mrs. Victor Conrad, Air Materiel Command Technical Report No. 5676, (Harvard-Mount Washington Icing Research Report 1946–1947) p. 484–594, June **1948.** 60 figs., graphs, 40 refs. **MH-BH**—The view is presented that most ice clouds form at or near water saturation and that the hypothetical sublimation nuclei, which have not as yet been established by systematic investigations, are none other than freezing nuclei. Questions of crystallization discussed. Forms of atmospheric ice crystals are explained. *Subject Headings:* **Ice crystal formation, Sublimation nuclei.**

**C–51** 551.578.41:551.574.1

Wall, E., **Die Eiskeimbildung in Lösungskernen.** [Ice crystal formation on hygroscopic nuclei.] Meteorologische Zeitschrift, 60:94–104, **1943.** 5 figs., 14 refs., 8 equations. **DWB**—Following the investigations of Volmer and Krastanow the author develops the conception of the formation of primary and secondary ice germs and deduces that in the atmosphere down to temperatures of about −40°C., the formation of ice particles takes place secondarily, i.e. through the liquid phase of water. *Subject Headings:* **Ice crystal formation, Condensation nuclei.**

C–52 551.578.41

Findeisen, W., and Schulz, G., **Experimentelle Untersuchungen zur atmosphärischen Eisteilchenbildung, I.** [Experimental investigations relating to the formation of ice particles in the atmosphere. I.] Fortschrift und Erfahrungsberichte des Reichswetterdienstes, A 27, **1944.** Deutscher Wetterdienst in der US-Zone, Berichte 1, Anhang, 1948. Army Air Force Library translation No. 387, by Charles Munschy. 13 figs., 12 refs. **DAWS, NSGE**—This work is part of a German series investigating formation of ice particles in the atmosphere. Data and evidence in support of conclusions are drawn from the development of ice particles with respect to formation of clouds, sequence of weather, and development and prevention of condensation trails. *Subject Heading:* **Ice crystal formation.**

C–53 532.77:551.578.41:551.574.1

Rau, W., **Gefriervorgänge des Wassers bei tiefen Temperaturen.** [Freezing of water at low temperatures.] Deutsche Akademie der Luftfahrtforschung, Berlin, Schriften, 8:65–84, **1944. DLC**—Freezing of supercooled water occurs on freezing nuclei. But below −72°C. ice forms directly from water vapor without the help of a nucleus. *Subject Headings:* **Physics of supercooled water, Ice crystal formation, Sublimation nuclei.**

C–54 551.574.1:551.578.41

Cwilong, B. M., **Sublimation in a Wilson chamber.** Nature, [London], 155:361–362, **1945. DLC**—Letter to the Editors: Ice particles form in clean air by sublimation; sublimation phenomena due to adiabatic cooling differ from phenomena of condensation since: (a) formation of ice particles seems to depend only on minimum temperature reached after expansion, (b) even in clean air they are formed at supersaturations far smaller than those necessary to form water droplets. *Subject Headings:* **Sublimation nuclei, Ice crystal formation.**

C–55 551.578.41

†Weickmann, H., **Formen und Bildung atmosphärische Eiskristalle.** [Shapes and formation of atmospheric ice crystals.] Beiträge zur Physik der freien Atmosphäre, 28:12+, **1945.** Translated by J. B. Schwartz, Naval Research Laboratory Library Translation No. 3. 42 p., 29 figs., 37 refs. **DLC**—Particles of high altitude ice clouds were observed by means of two methods of microphotography. It appeared that ice supersaturation is the regulating factor in formation of ice crystals, consequently development of a definite form was conditional upon definite temperature. *Subject Heading:* **Ice crystal formation.**

## 1946–1947

C–56 551.577.11

Humphreys, W. J., **The evolution of rain.** Franklin Institute, Journal, 241(6):391–396, June **1946.** equation. **DWB**—Different theories of the formation of rain and other types of precipitation are discussed. Formula given for the growth of rain drops falling through a cloud. *Subject Heading:* **Precipitation formation.**

C–57 551.578.41

Lonsdale, Kathleen, **Statistical structure of ice and of ammonium fluoride.** Nature, [London], 158:582, Oct. 26, **1946.** fig. **DLC**—Letter to the Editors: X-Ray examinations of crystals and speculations. *Subject Heading:* **Ice crystal formation.**

C–58 532.77:551.509.67

Cwilong, B. M., **Observations on incidence of supercooled water in expansion chambers and on cooled solid surfaces.** Journal of Glaciology, 2:53, **1947.** (Unchecked.) (Seeding ability of silver iodide was found not as high as that of zinc or cadmium evaporated *in vacuo.*) *Subject Headings:* **Supercooled water, Cloud seeding.**

C–59 551.574.1

Cwilong, B. M., **Sublimation in a Wilson chamber.** Royal Society of London, Proceedings, Ser. A., 190:137–143, **1947.** 2 figs., table, 10 refs. **DLC**—Experiments on condensation of water vapor in both dust-free and ordinary air are made. Clouds are considered made up of

supercooled water drops. Table summarizes experiments, type of air, expansion ratio, temperature: initial and after expansion, and products of expansion. Author says more evidence necessary to determine role of sublimation nuclei. *Subject Headings:* **Sublimination nuclei Condensation nuclei.**

C–60 551.574.1(494

Cwilong, B. M., **Sublimation in outdoor air.** Nature, [London], 160:198, **1947.** **DLC**—Brief note says that it appears that whatever sublimation nuclei are effective in lower air are usually absent at height of Jungfraujoch, Switzerland, where tests were made. *Subject Headings:* **Sublimation nuclei, Switzerland.**

C–61 551.577.

Dady, Georges, **Contribution à l'étude des precipitations.** [Contribution to the study o precipitation.] Académie des Sciences, Paris, Comptes Rendus, 225(25):1349–1351, Dec **1947.** 4 refs., equations. **DLC**—Note refers to theories of Köhler, Wigand and Schmauss Frankergerber and Bergeron. Number of collisions of water droplets per unit/time is calculated under controlled conditions. Water and oil vapors compared. *Subject Heading* **Precipitation formation.**

C–62 551.576.1

Kotsch, W. J., **An example of colloidal instability of clouds in tropical latitudes.** American Meteorological Society, Bulletin, 28:87–89, Feb. **1947.** 3 figs., 6 refs. **DLC**—Cause o colloidal instability within a cloud in tropical latitudes is either a high electrical charge of the water droplets or a factor or factors as yet unaccounted for. *Subject Heading:* **Cloud structure**

C–63 551.578.41:551.594.25

Schaefer, Vincent J., **Properties of particles of snow and the electrical effects they produce in storms.** American Geophysical Union, Transactions, 28(4):587–614, Aug. **1947.** 16 figs. 8 tables, 18 refs. **DWB**—*Subject Headings:* **Snow crystals, Electricity of precipitation.**

C–64 551.576.11

Schultz, G., **Die Arbeiten und Forschungsergebnisse der Wolkenforschungsstelle des Reichsamts für Wetterdienst in Prag.** [Investigation and laboratory results of Cloud Research Institute of the National Weather Service, Prague.] Deutscher Wetterdienst in der US-Zone [Bad Kissingen], Berichte, 1:3, **1947.** (Unchecked.) *Subject Heading:* **Cloud formation.**

C–65 551.577.11

Swinbank, W. C., **Collisions of cloud droplets.** Nature, [London], 159:849-850, June **1947.** fig. **DLC**—It is indicated that there are factors which oppose coalescence of cloud droplets. It is inferred that coalescence on impact will not occur unless drop diameters exceed 100 microns, or drizzle drop size. Surface tension causes tinier droplets to rebound from each other. When a larger drop was formed, it plunged downward scattering the smaller drops from its path. *Subject Heading:* **Rain formation.**

C–66 551.576-551.577.11:551.578.41

Weickmann, Helmut, **Elements of clouds and precipitation.** Field Information Agency, Technical, **1947.** U.S. F.I.A.T. Final Report No. 1063. 42 p., 18 figs., tables, 13 refs., equations. Text in German. **DLC**—First part of paper deals with investigations into microphysics of water droplet clouds. Second part contains microphotographs of ice particles and new data on their origin and growth. Third part shows by actual case data how the elements of precipitation may change their form by falling through clouds. *Subject Headings:* **Cloud physics, Precipitation formation, Ice crystal formation.**

**1948**

C–67 551.578.1

Blanchard, D. C., **Observations on the behavior of water drops at terminal velocity in air.** General Electric Research Laboratory, Schenectady, Occasional Report No. 7, Project Cirrus,

1948. 8 figs., 5 refs., 6 equations. **MH-BH**—Information concerning breakup of drops in non-turbulent and turbulent air streams. (Basic to water seeding.) *Subject Headings:* **Rain formation, Turbulence.**

**C–68** 551.515:551.574.42

*Clark, Victor, **Occurrence of icing at temperatures near the self-nucleating critical limit (−35°C.).** U. S. Air Force, Air Materiel Command, Technical Report No. 5676, p. 384–398, June 1948. table, refs. **MH-BH**—Table gives extensive weather data for storms at Mount Washington with minimum temperature below −35°C. This paper presents a summary and analysis of weather conditions in all such storms, with discussion of the significance of critical limit temperature, supercooling, freezing nuclei. *Subject Headings:* **Sublimation nuclei, Freezing nuclei, Icing, Storms.**

**C–69** 551.574.1

Cwilong, B. M., **Sublimation in the atmosphere over the oceans.** Nature, [London], 161:62, 1948. **DLC**—Brief note that gives measurements of highest temperature at which ice particles form in a Wilson expansion chamber; (experiments made over Atlantic and Pacific Oceans). It is concluded that there are probably no sublimation nuclei in the atmosphere at cirrus level except what are carried up by the convection in thunderstorms. *Subject Heading:* **Sublimation nuclei.**

**C–70** 551.574.1

Dessens, Henri, **Noyaux de condensation et pluie artificielle.** [Condensation nuclei and artificial rain.] Académie des Sciences, Paris, Comptes Rendus, 226:506–507, 1948. table. **DWB**—Discussion of the qualities and effectiveness of various chemical compounds that can be used as hygroscopic nuclei, taking into consideration droplet surface tension differences. *Subject Heading:* **Condensation nuclei.**

**C–71** 551.574.1:551.578.41

Dessens, Henri, **Sur les divers modes de condensation de la vapeur d'eau atmosphérique.** [On the various means of condensation of atmospheric water vapor.] Académie des Sciences, Paris, Comptes Rendus, 226(4):351–352, Jan. 1948. fig., ref. **DWB** -Effect of sodium chloride on formation of ice from supercooled water. *Subject Headings:* **Condensation nuclei, Ice crystal formation.**

**C–72** 551.578.41

†Dorsey, Ernest, **The freezing of supercooled water.** American Philosophical Society, Transactions, New Ser. 38, Part III:247–328, Nov. 1948. 98 refs. (Unchecked.) *Subject Heading:* **Supercooled water.**

**C–73** 551.576.11:551.574.1

Fournier d'Albe, E. M., **Condensation of water vapor below 0°C., cloud formation.** Nature, [London], 162:921–922, Dec. 11, 1948. 3 refs. **DLC**—Apparatus constructed permitting ultramicroscopic observation of individual condensation nuclei in an expansion chamber. Experiments made in outdoor air suggest that crystals are formed not by direct sublimation but by condensation and immediate freezing of water droplets. Experiments with clean air made; condensation occurs only on few remaining nuclei. No effect is noted from irradiation with gamma rays. *Subject Headings:* **Sublimation nuclei, Cloud formation.**

**C–74** 551.576.11:551.577.11:551.574.1(54)

†Saha, K. R., **Cloud and rain.** Science and Culture, 14(5):178–186, Nov. 1948. 5 figs., 4 tables, 25 refs. **DLC, NSGE**—Cloud making, drop formation, sublimation nuclei, etc., are discussed. Attention given to formation of rain clouds in India. *Subject Headings:* **Rain formation, Sublimation nuclei, India.**

**C–75** 551.578.41:551.574.1

†*Schwerdtfeger, W., **[Comparison for the conditions for the formation of water drops and ice particles.]** English translation in Air Materiel Command, Technical Report No. 5676,

(Harvard-Mount Washington Icing Research Report 1946–1947), p. 595–635, June **1948.** 3 figs., 33 refs., 18 equations. **MH-BH**—It is stated that even if the secondary formation of ice germs in the free atmosphere plays an important role in formation of atmospheric ice particles, it is not necessary that all nuclei well-fitted for condensation have the same qualification for the formation of ice germs. Thus with the assumption of the formation of secondary ice germs it would be possible to keep up the conception of an occasional lack of sublimation nuclei (after Findeisen). Facts concerning the formation of water drops and ice particles are considered; hygroscopic effect of the dissolved nuclei substance and the influence of the curvature of the surface upon the equilibrium of the vapor pressure, etc. are discussed. *Subject Headings:* **Ice crystal formation, Sublimation nuclei, Condensation nuclei.**

**C–76** 551.578.11

Schwerdtfeger, W., **Über die Bildung von Regenschauern über See.** [On the formation of showers over the sea.] Meteorologische Rundschau, 1(15–16):453–456, **1948.** fig., 4 tables, 13 refs. Summary in German and English. **DWB**—*Subject Heading:* **Rain formation.**

**C–77** 551.578.1

Shiskin, N. S., **K voprosu o roste kapel' v oblakakh i tumanakh.** [On the question of the growth of cloud and fog droplets.] Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofiz., 12(3):249–254, **1948.** 2 figs., 2 tables, 8 refs., 10 equations. **DWB, DLC**—Coagulation of droplets in clouds and fogs is caused by difference in speed of fall. Theoretical calculations on the growth of divided droplets according to their sizes are given. Comparison of results, thus obtained with microphotographic evidence is made. *Subject Heading:* **Rain formation.**—*M.R.*

**C–78** 532.77:551.574.1

Smith-Johannsen, Robert, **Some experiments on the freezing of water.** General Electric Research Laboratory, Schenectady, Occasional Report No. 3, Project Cirrus, June 1, **1948. DWB**—It is found that water with no air-solid interface below 0°C. in contact with the liquid, normally freezes at approximately −20°C. However, water which had been exposed to ultrasonic radiation froze in one case at −38.5°C. Various powders were added to the water to serve as freezing nuclei. Concluded that "freezing" and "sublimation" nuclei must be distinguished from one another. *Subject Headings:* **Supercooled water, Sublimation nuclei, Freezing nuclei.**

1949

**C–79** 551.574.1:551.578.1(26)

Byers, Horace R., **Condensation nuclei and precipitation.** Journal of Meteorology, 6(5):363, Oct. **1949. DWB**—Correspondence: Low nuclei counts over oceans are noted, a factor to be considered in explanation of rain cloud development in clouds at above freezing temperatures over tropical oceans. *Subject Headings:* **Rain formation, Condensation nuclei, Tropical oceans.**

**C–80** 551.510.41:551.574.1:551.586.1

†Cauer, H., **Ergebnisse chemisch-meteorologischer Forschung. Fragen der Wolkenbildung unter chemischem, elektrostatischem und elektromagnetischem Einfluss.—Bioklimatische Betrachtungen.** [Results of chemical-meteorological research. Questions of cloud formation under chemical, electrostatic and electromagnetic influences.—Bioclimatic considerations.] Archiv für Meteorologie, Geophysik und Bioklimatologie, Ser. B., 1(3–4):221–256, Nov. **1949.** data, 62 refs. Abstracts in German, English, French and Spanish. **DWB, MH-BH**—Chemical meteorology is chiefly concerned with formation of clouds. A detailed and technical investigation is made on the origin and nature of condensation and sublimation nuclei: amount, origin, distribution and development and circulation of iodine in the air under the influence of light and ozone; development, occurrence, daily variation and the coagulating of fog nuclei; forming effect of ozone. The spirit water theory is checked. New theoretical considerations on the chemical separation of droplets by wind dispersion, are

treated. Electric properties of droplets and physicochemical, electrostatic and electromagnetic causes of condensation are developed. *Subject Headings:* **Condensation nuclei, Sublimation nuclei.**

**C–81** 551.511:551.576.11

Craddock, J. M., **The effect of water droplets on the buoyancy of a rising cumulus cloud.** Meteorological Magazine, [London], 78(930):351 354, Dec. **1949.** fig. **DWB**—Upcurrents below freezing level retain most of their condensed water, and this adds to their density and decreases convection. Author gives tephigram showing curves of this "convective stability" compared with saturated adiabatics (water and ice). At high temperatures effect is important. *Subject Heading:* **Cloud structure.**—*C.E.P.B.*

**C–82** 551.574.1

Fournier d'Albe, E. M., **Some experiments on the condensation of water vapour at temperatures below 0°C.** Royal Meteorological Society, Quarterly Journal, 75:1–14, Jan. **1949.** fig., 7 refs. **DLC**—Apparatus is developed for ultramicroscopic observation of behavior of individual condensation nuclei. Particular attention is paid to problems of distinguishing between water droplets and ice crystals and of determining conditions necessary for formation of the latter. Outdoor air nuclei and artificial nuclei examined. *Subject Headings:* **Condensation nuclei, Ice crystal formation.**

**C–83** 551.575.1:551.574.1

Heverly, J. R., **Similitude of artificial and natural fogs.** American Geophysical Union Transactions, 30(1):15–18, Jan. **1949.** 2 figs., 4 tables, 4 refs. **DWB**—Experimental studies of condensation nuclei and laboratory fog investigations are made. *Subject Headings:* **Condensation nuclei, Fog.**

**C–84** 551.577.11:551.574.1:551.509.67

†Heverly, J. R., **Supercooling and crystallization.** American Geophysical Union, Transactions, 30(2):205–210, April **1949.** 3 figs., table, 21 refs. Abstract. **DWB**—Supercooling of water droplets under conditions found in nature is quantitatively studied. Temperature at which water vapor will crystallize to form snow is determined. Spontaneous freezing point is presented in graph as function of drop size. Results of supercooling and crystallization investigations indicate that the current precipitation theories need modification. Colloidal instability of the cloud resulting from supercooled water droplets' crystalline sublimation onto ice pellets initiates precipitation. Bergeron-Findeisen ice crystal requirements are held no longer necessary. Silver iodide and dry ice seeding are mentioned as effective for cloud modification. *Subject Headings:* **Precipitation formation, Sublimation nuclei, Cloud seeding.**

**C–85** 551.576.11:551.574.1

†*Howell, Wallace E., Wexler, Raymond, and Braun, Seymour, **Contributions to the theory of the constitution of clouds.** Mount Washington Observatory Research Report. Quarterly Progress Report, Jan. 20, **1949.** 14 p., 3 figs., 15 refs. Appendix of cloud data observations, Oct.–Dec. 1948. **MH-BH**—From author's abstract: As preliminary to undertaking a series of integrations of cloud droplet growth, a study of the size spectrum of atmospheric condensation nuclei is presented, leading to the adoption of a nuclei size distribution based on observations by Woodcock as the starting point for the integrations. *Subject Headings:* **Cloud formation, Condensation nuclei.**

**C–86** 551.576.11:551.574.1

†*Howell, Wallace E., **The growth of cloud drops in uniformly cooled air.** Blue Hill Meteorological Observatory, Harvard University, Reprint No. 6, **1949.** p. 134–149. 16 figs., 5 tables, 30 refs. **MH-BH**—Study is made of drop size spectrum when air containing condensation nuclei is uniformly cooled. *Subject Headings:* **Condensation nuclei, Cloud structure.**

C–87 551.576.1

Mount Washington Observatory, Staff, **Contributions to the theory of the constitution of clouds. Part I.** Mount Washington Observatory Research Report. Final Report year ending Oct. 20, **1949.** 43 p., 12 figs., 5 tables, 6 refs., equations. **MH-BH**—I. Summary is made of the theory for the drop size distribution in clouds by Howell, Wexler, and Braun. A study of meteorological conditions conducive to icing on Mount Washington is made by Roland Boucher. Part II deals with a study of laws governing physical constitution of clouds and processes involved in growth maintenance and decay of cloud formations. Series of analyses of simplified models of processes of cloud formation are made. Growth of an individual cloud droplet is studied on the basis of diffusion of water vapor in response to a vapor pressure gradient between the surface of a droplet and the surrounding air. Information about nucleus sizes is reviewed. A representative size distribution is postulated as well as integrations of drop size and concentrations at different cooling rates, made. Distribution of vertical velocity in clouds is discussed. *Subject Heading:* **Cloud physics.**

C–88 551.524:551.576.11:551.574.1

Ogiwara, Sekiji, **On the air temperature and the growth of cloud particles in convective clouds; (studies on the formation of cloud and rain. Part I).** Science Reports of the Tohoku University, Fifth Ser., Geophysics, 1(1):21–23, Feb. **1949.** fig., refs., 5 equations. **DWB**—Author studies the distribution of the temperature of the air and the growth of cloud particles in the ascending current which contains condensation nuclei. *Subject Headings:* **Cloud formation, Condensation nuclei.**

C–89 551.578.1:551.574.1

Ogiwara, Sekiji, **On the formation of rain drops in clouds which are entirely composed of water; (studies on the formation of cloud and rain. Part II).** Science Reports of the Tohoku University, Fifth Ser., Geophysics, 1(2):83–86, Nov. **1949.** 3 figs., 3 refs., 6 equations. **DWB**—Calculations are made to obtain the rate of growth of rain drops by coagulation due to relative rates of fall, disregarding the effect of turbulence of the air. The Bergeron-Findeisen theory of ice crystal nuclei is disputed. *Subject Headings:* **Rain formation, Condensation nuclei.**

C–90 551.574.1:551.577.11

Palmer, H. P., **Natural ice-particle nuclei.** Royal Meteorological Society, Quarterly Journal, 75(323):15–22, **1949.** 3 figs., 10 refs., equations. **DWB**—Determinations are made of temperature for the first formation of ice in a small cloud chamber at different levels in the free atmosphere. Estimate made of threshold temperatures for the concentrations of these nuclei in surface air required to form two types of rain. *Subject Headings:* **Rain formation, Ice crystal formation, Sublimation nuclei.**

C–91 551.574.1

Rau, Walter, **Unterkühlbarkeit des Wassers und atmosphärische Eisbildung.** [Supercooling of water and formation of atmospheric ice.] Wetter und Klima, 2(3–4):81–92, March–April **1949.** 3 figs., 9 refs. **DWB**—Author cooled water drops on polished chromium surface in closed chamber. They froze repeatedly at one temperature, then suddenly changed to lower and lower temperatures. Freezing began at a different point in each case, but at −72°C. freezing began simultaneously at many points. Drying the drops made the nuclei active again. Fresh drops froze at −4° to −6°C.; after ten freezings frequency curve showed maximum at −11°C., subsidiary maxima at −4° and −19°, lowest −33°C. Peppler found formation of haloes at −11°C., rime at −3 to −9°C. Ice forms rapidly on very dry nuclei just under 0°C., e.g., by scattering dust on supercooled water. *Subject Headings:* **Ice crystal formation, Freezing nuclei.**—*C.E.P.B.*

C–92 551.574.1

Schaefer, Vincent J., **The detection of ice nuclei in the free atmosphere.** Journal of Meteorology, 6(4):283–285, Aug. **1949.** 3 figs., 3 tables, 5 refs. **DWB**—Three techniques are described. It is hoped that they will help in understanding erratic occurrence of super-

cooled clouds in the free atmosphere. Much more data are needed before attempting to establish relationships which probably exist between number of sublimation nuclei in the atmosphere and the frequency of supercooled clouds or snow. *Subject Headings:* **Cloud formation, Sublimation nuclei.**

**C–93** 551.578.41:551.574.1:551.509.67

Schaefer, Vincent J., **The formation of ice crystals in the laboratory and the atmosphere.** Chemical Reviews, 44(2):291–320, April **1949.** 22 figs., 5 tables 20 refs. **DLC**—Summary of author's laboratory and field activities in experimental meteorology. Properties of snow particles and electrical characteristics are discussed. Techniques for detecting sublimation nuclei in the free atmosphere are given, involving cold chamber and supercooled films. Description of technique and procedure used in simulating natural clouds. Role of dust particles as sublimation nuclei. Effect on the crystal habit of ice produced by the blocking action of adsorbed surface active polar molecules is shown. Some aspects of the cloud modification studies initiated by the author in 1946 are described, with some observed results and discussion of relationships believed to exist in unstable clouds. *Subject Headings:* **Ice-crystal formation, Sublimation nuclei, Cloud seeding.**

**C–94** 551.578.41:551.574.1

Vonnegut, Bernard, **Note on nuclei for ice crystal formation.** American Meteorological Society, Bulletin, 30(5):194, May **1949.** 3 refs. **DWB**—Various substances for producing nuclei for ice crystal formation, taking temperature into consideration, are briefly discussed. *Subject Headings:* **Ice crystal formation, Sublimation nuclei.**

**C–95** 551.578.4:551.574.1

†*Weickmann, Helmut, **Die Eisphase in der Atmosphäre.** [The ice phase in the atmosphere.] Deutscher Wetterdienst in der U. S. Zone, Berichte No. 6, **1949.** 54 p., 53 figs., 51 photos, 3 tables, 73 refs. **DWB**—Translated by Mrs. M. G. Sutton, Wölkenrode Report and Translation No. 716, Feb. 1947, Library Translation No. 273. Ministry of Supply, Sept. 1948. 96 p., 42 figs., 50 plates, tables. **NSGE**—(Also in Prof. Wallace E. Howell's private library). From author's summary: results of six years' research on formation, appearance, occurrence, and growth of the ice phase in the laboratory, on the ground, and in the atmosphere up to altitudes of 32,500 feet are given. The most important result is the theoretical and experimental proof that no sublimation nuclei exist and that down to cirrus temperatures crystals form on freezing nuclei via the state of water saturation, or at least at ice supersaturation humidities. At the same time the key to the explanation of the shape and growth of the principal types of atmospheric ice crystals, the plates and prisms, is found. *Subject Headings:* **Ice crystal formation, Sublimation nuclei, Freezing nuclei.**

## 1950

**C–96** 551.574.1:551.576.1

Ludlam, F. H., **The composition of coagulation elements in cumulonimbus.** Royal Meteorological Society, Quarterly Journal, 76(327):52–58, Jan. **1950.** 3 figs., table. Ice particles exceeding 1 mm. diameter in dense supercooled cumuli-form cloud grow by coagulation with water drops. Loss of heat may be too slow for all acquired water to freeze even at −20° to −30°C. Above diameter 0.6 cm. surface liquid may be disrupted into droplets (Langmuir's chain multiplication); this may be important in producing splinter ice nuclei and generating thunderstorm electricity. Below −32°C. this coagulation ceases. *Subject Heading:* **Cloud formation.**—*C.E.P.B.*

**C–97** 551.574.1

Mason, B. J., **The nature of ice forming nuclei in the atmosphere.** Royal Meteorological Society, Quarterly Journal, 76(327):59–74, Jan. **1950.** fig., summary table. Two-page summary of experimental results by nine authors 1935–1949 is given. Nuclei causing freezing: 0° to −32°C., solid insoluble droplets of sea salt solution, ice and salt crystallizing out on con-

taminating foreign particles; just below −41°C., pure salt solution and possibly gaseous nuclei. Ice crystals may form spontaneously from supersaturated vapor without nuclei between −50 and −90°C. *Subject Headings:* **Freezing nuclei, Sublimation nuclei.**—*C.E.P.B.*

C–98 551.574.1

Schaefer, Vincent J., **The occurrence of ice nuclei in the free atmosphere.** General Electric Research Laboratory, Schenectady, Occasional Report (No. 19), Project Cirrus, 1950 (Forthcoming publication). 7 figs., table, 12 refs. Extended periods of high counts of sublimation nuclei at Mount Washington Observatory between Jan. 1, 1948, and Sept. 1, 1949, are noted. *Subject Heading:* **Sublimation nuclei.**

C–99 551.576:551.509.67

Perrie, D. W., **Cloud physics.** New York, John Wiley and Sons. In preparation. This book is to contain such topics as classification of clouds, materials of which clouds are composed processes of cloud formation, nuclei of condensation and sublimation, problems of precipitation including rainmaking experiments. *Subject Headings:* **Cloud physics, Cloud seeding.**

C–100 551.576:551.509.67

†American Meteorological Society, **Compendium of meteorology.** In preparation: to be published in 1950. Section on cloud physics, tentative table of contents: Houghton, H. G., **General cloud physics.** Brunt, D., **Experimental cloud formation.** Ludlam, F. H., **The physics of ice-cloud and mixed clouds.** Möller, F., **Thermodynamics of clouds including the formation of droplets and crystals on natural nuclei.** Cwilong, B. W., **Behavior of water in its various phases at low temperature.** Schaefer, V. J., **Snow and cloud modification.** Gunn, R., and Coons, R. D., **Results of over 170 experiments on the artificial modification of clouds and production of precipitation.** Junge, C., **Nuclei of atmospheric condensation.** Nakaya, U., **Supercooled clouds and the formation of ice crystals.** *Subject Headings:* **Cloud physics, Precipitation formation, Cloud seeding.**

## RAINMAKING AND ARTIFICIAL NUCLEATION OF CLOUDS

### 1891–1929

C–101 551.509.67

†Gathmann, Louis, **Rain produced at will.** Chicago, 1891. 61 refs. **DWB**—Author says rain can be produced only by cooling upper regions of the atmosphere enough to condense water vapor. A method of suddenly chilling the atmosphere by rapid evaporation is designed to produce condensation in the upper air in such quantities that a cloud will form from which rain will fall. This is to be done by liberating liquified carbonic acid gas, shot into the atmosphere or released from a balloon. *Subject Heading:* **Artificial precipitation.**

C–102 551.509.67

†Harrington, M. W., **Weather making, ancient and modern.** Smithsonian Report for 1894. National Geographic Magazine, 6:35–62, April 1894. 75 refs. (p. 269–270). **DWB**—Superstitions and religious methods of rainmaking and stopping are discussed, and other methods such as noise, concussion, smoke or dust, expansion of carbon anhydride, electricity, conflagration. *Subject Heading:* **Artificial precipitation.**

C–103 551.509.67(931)

*A(bbe), C(leveland) and Bates, D. C., **Rain-making in New Zealand. . . . Report upon the dry period and rain-making experiments at Oamaru, New Zealand.** Monthly Weather Review, 36:208–213, July 1908. fig., tables. **DLC**—Actual data are recorded to show what happened in experiments which attempted to make rain by means of dynamite explosions. *Subject Headings:* **Artificial precipitation, New Zealand.**

C–104 551.509.67

Brooks, Charles F., **Professional "rain-makers."** American Meteorological Society, Bulletin, 1:47–48, May 1920. **DWB**—Brief article warning against quack rainmakers. *Subject Heading:* **Artificial precipitation.**

C–105 551.509.67

Shaw, Napier, **The artificial control of weather.** Monthly Weather Review, 49:244–246, April 1921. **DWB**—Resumé of a lecture delivered before the Cambridge University Aeronautical Society. Various methods are suggested for producing rain, including electrical methods, discharge of dust into the atmosphere, detonations, etc. It is said, "Mr. Cole, a Canadian airman, suggests rain production by means of liquid air sprayed from an aeroplane. While a certain amount of condensation is thus assured, there is a risk that the rain might evaporate before reaching the ground.—To water a countryside would need a good deal of liquid air." *Subject Heading:* **Artificial precipitation.**

C–106 551.509.67

———**Sand blasting the clouds for man-made weather.** Scientific American, April 1923. p. 13. **DLC**—Description of spraying clouds with electrically charged sand, to produce rain. *Subject Heading:* **Artificial precipitation.**

C–107 551.509.67:551.578.1

Humphreys, William Jackson, **Rainmaking and other weather vagaries.** Baltimore, Williams and Wilkins Co., 1926. 157 p., refs., p. 92. **DWB**—Part I. Account of magical, religious, and (pseudo-) scientific rain-making attempts. Clearing away clouds and fog, fighting hailstorms, drought, and how nature produces rain are discussed. *Subject Headings:* **Artificial precipitation, Rain formation, Weather lore.**

C–108 551.509.67:551.577.1

Wendler, August, **Das Problem der technischen Wetterbeeinflussung.** [The problem of technical weather control.] Probleme der Kosmischen Physik, No. 9, Hamburg, 1927. 107 p., 4 figs., 104 refs. **DLC**—Existing knowledge in the field of artificial influencing of weather is reviewed, including various methods with gunfire, detonations, electricity, etc., in Australia, America, and other countries. Effects of smoke, forest fires, cities, forests, the sea, etc., are considered. Research in precipitation formation, condensation nuclei, conditions of instability, release of heat energy, etc., are discussed. *Subject Headings:* **Artificial precipitation, Precipitation formation.**

1930–1939

C–109 551.509.67(492)

———**Clouds sprayed with dry ice made to yield rain.** Popular Mechanics, 54(3):418, Sept. 1930. **DLC**—Brief report of a Dutch scientist's rain-making experiments. (See Veraart, August W., C–112 to C–116.) The theory is postulated that falling particles of dry ice become laden with electricity transforming them into numerous very small drops; these convert the clouds into larger drops causing them to dissolve or condense into rain. *Subject Headings:* **Cloud seeding, Holland.**

C–110 551.509.67(492)

Grunow, Johannes, **Der Künstliche Regen des Holländers Veraart.** [The artificial rain of the Dutchman Veraart.] Die Umschau, 34(30):602, 1930. Photostat copy. **DWB**—Theory of rain formation. Description of Veraart's experiment of dropping in a cloud 1,500 kg. of powdered ice cooled to −78°C. with dry ice. Pilots of four airplanes verified that along a 10 km. strip of the Zuider Zee streaks of rain were produced. It was not proven that the rain reached the earth. Earlier experiments of K. Wegener (1923) are reviewed in which he poured liquid air from an airplane at the base (*sic*) of a cloud, without appreciable results. It was concluded impossible to produce rain over a large enough area, especially in times of drought, since at such times the air is stable, clouds scarce, and surface air so dry that rain would evaporate before reaching the ground; and when conditions are favorable, nature takes care of making it rain. *Subject Headings:* **Cloud seeding, Holland.**—*M.R.*

C–111 551.509.67(492)

van Everdingen, E., **De Zware Regenval op 6/7 October 1930.** [Heavy rainfall of 6/7 Oct. 1930.] Hemel en Dampkring, 29(10):321–2, Oct. 1931. fig. **DWB**—An analysis of the rainfall and air-flow over Holland on the day following the last demonstration by August

Veraart (see C–114). A chart is included to prove that Veraart's claim to have artificially produced a record rainfall over all of Holland, was greatly exaggerated; and that the prevailing air-flow was from the WNW, not the WSW as was claimed by Veraart: hence the heavy rainfall at Hoorn during the night could not have been produced by seeding air masses which by that time were far to the eastward and inland. *Subject Headings:* **Cloud seeding, Weather control, Holland.**—*M.R.*

**C–112** 551.509.67(492)

Veraart, August W., **Meer Zonneschijn in het Nevelig Noorden; meer Regen in de Tropen.** [More sunshine in the cloudy north; more rain in the tropics.] Amsterdam, N. V. Seyffardt's Boek & Muziekhandel, **1931.** 32 p., 6 refs. Photostat copy. **DWB**—History of author's interest in and ten years' experimenting with artificial rain production. Economic advantages of such control; possible methods of modification of clouds, fog, thunderstorms, and rain; experiments with seeding of clouds with dry ice, supercooled water-ice and carbon dioxide mixtures, ammonium salts, etc. Dates of public demonstrations in Holland: Soesterberg, July 3 and 19, and Scheveningen, Aug. 7 and Oct. 6, 1930. Explanation of possible physical effects: upset of stability or release of latent instability in clouds, release of latent heat and resulting convection and turbulence, propagating waves producing divergent effects at great distances, cooling of supercooled and supersaturated clouds by "tens of thousands of swirling and undulating ice particles." *Subject Headings:* **Weather control, Cloud seeding, Holland.**—*M.R.*

**C–113** 551.509.67(492)

Veraart, August W., **Meer Zonneschijn in ons Nevelig Noorden.** [More sunshine in the cloudy North.] Natuur en Techniek, p. 24–28, April **1931.** 6 photos. **NNM**—In the first volume of an excellently illustrated Dutch popular science magazine appeared a summary of Veraart's work and theories, together with pictures of various types of clouds—both fair and bad weather types, taken in the region of Holland and in the tropics. The gist of the author's theory is that the dry ice or ice mixtures cool the upper inversion layer, which prevents the further growth of the cloud and increases the moist instability, thus setting off rapid convective activity that might otherwise not be realized. He also thought that the rapidly falling ice particles upset the electric field of cloud and that myriads of ice particles swirling in a supercooled (−10° to −20°C.) cloud of water droplets would produce condensation and liberate latent energy resulting in further convection and even in self-propagating effects. Extravagant possibilities of controlling weather through these means are developed at some length. *Subject Headings:* **Cloud seeding, Holland.**—*M.R.*

**C–114** 551.509.67(492)

Veraart, August W., **Opzienbarende cijfers; officieele rapporten van De Bilt na de proeven van den heer Veraart.** [Sensational data; official report from De Bilt on the demonstrations of Veraart.] Natuur en Techniek, 1(5):183–185, Aug. **1931.** fig. **NNM,** Photostat copy: **DWB**—Dry ice was seeded in clouds Oct. 6 and 7, 1930, and rainfall data for Holland during that period showed that heavier rain fell then than at any time previously, (although in some places this was not the case). A rough isoline chart of the Netherlands shows the heaviest rain (35 to 53 mm.) fell in a strip from the North Sea coast inland across the Zuider Zee to the mainland, just northeast of Amsterdam, with decreasing amounts to the northeast and southwest of that strip. More than 80% of this fell from 4:30 p.m. on the day of the demonstration to 8 a.m. the next day. The ice was dropped from the airplane upwind between 3:45 and 4:30 p.m. (Oct. 6, 1930). A rain squall was seen under the cloud by a second pilot ten minutes after the ice was dropped, and the cloud was seen to increase in depth by ten times. The author claims that precipitation induced in one cloud sets off precipitation in neighboring clouds as the system moves along. *Subject Headings:* **Cloud seeding, Holland.**—*M.R.*

**C–115** 551.509.67(492)

Veraart, August W., **Voorloopig antwoord aan Prof. Dr. E. van Everdingen in verband met het artikel "Zware Regenval op 6/7 Oct. 1930."** [Provisional answer to Prof. Dr. van

Everdingen in connection with the article "Heavy rainfall on 6/7 Oct. 1930."] Photostat copy, 1931. **DWB**—Included in this paper is a summary of dry ice and dry ice and water-ice cloud seeding experiments in the top of supercooled clouds made by Veraart; published results (all in Dutch newspapers or periodicals); and scientific basis for belief that rain was actually produced on several occasions during 1930 with verification by pilots and reporters who witnessed demonstrations. This tract is written in answer to a criticism in Hemel en Dampkring (Oct. 1931) by Prof. van Everdingen, head of the Royal Dutch Meteorological Service. Appended is a letter from Veraart to the Minister of Education, Art and Science, dated 9 Nov. 1931, defending his experiments and his knowledge of cloud physics against van Everdingen's charge that he is a non-meteorologist and charlatan. The two page report from van Everdingen to the Minister is appended. Van Everdingen gives scientific reasons why Veraart's claim of success Oct. 6, 1930, is exaggerated, and further recommends that a subsidy of 1,000 fl. be refused Veraart. *Subject Headings:* **Cloud seeding, Holland.**—*M.R.*

**C–116** 551.509.67(492)

Veraart, August W., **Records van zonneschijn en regen in 1930. Rede gehouden voor de K.R.O. microfoon op Zondag 29 Mei 1932.** [Records of sunshine and rain in 1930. Speech made before the KRO radio on Sunday, May 29, 1932.] Photostat copy. **DWB**—This is the last publication by Veraart before he died. Mention is made of a test by the Soviets in Moscow-Leningrad region wherein they claimed to have produced precipitation from clouds. Author analyzes sunshine and precipitation records for all of Holland for June, 1930, and compares the monthly rainfall for June–Nov. 1930, with normal and extreme years, in an attempt to prove that his experiments resulted in the rainiest summer on record. Dates and places of the various demonstrations are given and height (3,000 to 4,000 m.) at which the dry ice and water ice mixture was dropped from the plane. He summarizes the physical basis for his experiments: 1) that extreme vertical turbulence and waves are set up when myriads of ice particles suddenly fall through a cloud mass; 2) that this is especially true when the cloud top consists of supercooled water drops at $-10°$ to $-20°$C. (an extremely unstable condition); 3) that often these clouds are more than 100% saturated with respect to water, and if ice forms, intense precipitation can result; 4) the volume of gaseous $CO_2$ at this low temperature is 700 times greater than the solid $CO_2$, so a small amount of the latter could cause a great deal of cooling and displacement. The author also points out that it often rains more by night than by day in places where the cloud tops cool faster than the bases (low clouds over warm water masses), and he proposes to produce both more rain and more sunshine by setting off the rain before dawn, allowing the sky to become less saturated by day, increasing sunshine, and reducing chances of thunderstorms and hail. *Subject Headings:* **Cloud seeding, Holland.**—*M.R.*

**C–117** 551.509.67

Görög, Henrik and Rovó, Aladár, **Kísérlet mesterséges esö elöallítására.** [Projekt zur künstlichen Regenerzeugung.] [Project for artificial production of rain.] Idöjárás, 14(1–2):2–9, Jan.–Feb. **1938.** In Hungarian. Summary in German p. 43–45. **DLC**—Considering the theory that forest or prairie fires might so affect the latent saturation and instability conditions of the atmosphere so as to cause precipitation, it is suggested that a layer of oil spread on water and ignited might under favorable conditions cause rainfall for relief of drought. Amount of energy produced and its effect on the atmosphere are calculated, as well as the amount of possible resulting rainfall. Allowance is made for losses due to radiation, evaporation divergence, etc. Comments on the paper by W. Dickson of the Ministry of Agriculture in Ottawa are included. *Subject Heading:* **Artificial precipitation.**—*M.R.*

**C–118** 551.575.1:551.509.65

Houghton, H. G. and Radford, W. H., **On the local dissipation of natural fog.** Massachusetts Institute of Technology and Woods Hole Oceanographic Institute, Papers in Physical Oceanography and Meteorology, vol. 6, No. 3, Oct. **1938.** 63 p. **DWB**—The possibilities of fog dissipation are discussed. A method is suggested and described for spraying fog with calcium chloride solution, and a new type of apparatus is described for the dissipation of fog by means of fine hygroscopic particles. *Subject Heading:* **Fog dissipation.**

1940–1945

C–119 551.509.67:551.578.

Puig, Ignacio, **Se puede provocar artificialmente la lluvia?** [Is it possible to create artificial rain?] Revista Meteorológica, Montevideo, 3:56–62, **1944.** **DLC**—Review of early experiments to make rain by cannon fire, chemical brews, etc. in Australia, U. S., and France. Three processes of natural formation of precipitation are discussed briefly: direct cooling, mixtures of masses of cold and warmer air, and adiabatic cooling. *Subject Headings:* **Artificial precipitation, Rain formation.**

1946–1947

C–120 551.509.6

——— **Man-made snowstorms; scientist can make it fall in laboratory or in the sky.** Life, 21:52–54, Dec. 30, **1946.** illus. **DLC**—Brief popular report of Vincent Schaefer's experiments of seeding clouds with dry ice. Good photographs. *Subject Heading:* **Cloud seeding.**

C–121 551.578.41:551.509.6

Schaefer, Vincent J., **The production of ice crystals in a cloud of super-cooled water droplets.** Science, 104:457–459, Nov. **1946.** 2 figs., (photographs of snow crystals), ref. **DLC**—It is reported that supercooled liquid water clouds spontaneously transform from water to ice when the temperature is −35°C. or lower. At temperatures of −20°C. the addition of fine particles of a wide variety of substances is without effect on the supercooled cloud. *Subject Headings:* **Ice crystal formation, Cloud seeding.**

C–122 551.509.67:551.577.11(94

Bannon, J. K., **Artificial stimulation of rain formation.** Meteorological Magazine [London], 76(902):169–174, Aug. **1947.** 6 refs. **DWB**—Australian experiments in cloud seeding with dry ice are reviewed. Formation of rain in the cloud; formation of ice crystals and consequent release of heat; change in the saturated adiabatic lapse rate of temperature; conditions favorable for stimulation of clouds are discussed. Discussion. Meteorological Magazine, [London], 77:62–64, **1948.** *Subject Headings:* **Precipitation formation, Cloud seeding, Australia.**

C–123 551.509.67

Bee, E., **Weather overseas. Helping it to rain; (Australian scientists "interviewed").** Weather, 2:153–156, **1947.** plate, ref. **DLC**—Report of dry ice cloud seeding near Sydney, 1947, and description of other Australian experiments "of the same kind" requiring "massive cumulus clouds." It is emphasized that details of this process of rain formation are not yet understood. Some discussion of theory of precipitation formation is included. Suggestion is made that other substances (unspecified) having shapes similar to ice crystals might be introduced into clouds as nuclei. *Subject Headings:* **Cloud seeding, Australia.**

C–124 551.509.67

Black, Charles L., **Making rain with an airplane.** Flying, 41(5):28–29, Nov. **1947.** illus. **DLC**—Popular article tells difficulties, cautions and details of rain production from supercooled clouds. *Subject Heading:* **Cloud seeding.**

C–125 551.509.67:551.577.11

Brandejs, Stanislav, **Umělé srážky.** [Artificial precipitation.] Meteorologické Zprávy, Prag, 1:71–72, **1947.** refs. In Czech. **DWB**—Brief article discusses cloud seeding experiments of Kraus and Squires, Langmuir and Schaefer, and ice crystal theories of Bergeron, Findeisen, Peppler, etc. *Subject Headings:* **Cloud seeding, Precipitation formation.**

C–126 551.509.67

Brun, Edmond and Demon, Lucien, **Sur la formation artificielle de la pluie.** [On the artificial formation of rain.] Académie des Sciences, Paris, Comptes Rendus, 225(12):505–506, Sept. **1947.** ref. **DLC**—Report of dry ice seeding experiments in the laboratory. *Subject Heading:* **Cloud seeding.**

C–127 551.509.6

——— **Can science do something about your town's weather?** Science Illustrated, 2(5):13–17, May **1947.** illus. **DLC**—Questions are discussed on the prevention of rain waste, land waste, prevention of snow in cities, reduction of hail damage, cooling of cities in summer, dispelling of fog, averting of thunderstorms, detouring of hurricanes, and prevention of tornadoes. *Subject Heading*: **Weather control.**

C–128 551.509.67

Francis, J., **Peut-on "faire pleuvoir."** [Can one make it rain.] Science et Vie, Paris, 72(362):256–258, **1947.** fig., 2 refs. **DLC**—Popular style article discusses theory of dry ice seeding and its practicality. Use of liquid air for inducing precipitation is mentioned. *Subject Heading:* **Cloud seeding.**

C–129 551.509.67:551.574.1

General Electric Research Laboratory, **First quarterly progress report, Meteorological Research.** Schenectady, New York, July 15, **1947.** 37 p., 12 figs., 3 tables, 19 equations. **DWB**—

Part I. Schaefer, Vincent J., **General summary of cloud studies project.**

II. Langmuir, Irving, **Summary of results thus far obtained in artificial nucleation of clouds.**

III. Schaefer, **Techniques for seeding clouds with ice nuclei.**

IV. Falconer, Raymond, E., **Instrumentation developments for the cloud study project.**

V. Vonnegut, Bernard, **Nucleation of ice formation by silver iodide particles.**

VI. Falconer, **Typical data obtained from photographs of a seeded area.**

VII. Langmuir, **The analysis of photographic data showing the effects produced by seeding supercooled clouds with ice nuclei.**

VIII. Langmuir, Schaefer, Vonnegut, **Proposed flight plans for cloud studies.**

*Subject Headings:* **Cloud seeding, Sublimation nuclei.**

C–130 551.509.67 551.509.3

Kaempffert, Waldemar, **Making weather to order.** Science Digest, 22(5):1–5, Nov. **1947. DLC**—Part I. Popular account of cloud seeding experiments of Langmuir, Schaefer, and Vonnegut. Besides dry ice, silver iodide, lead iodide, iodoform, iodine crystals, apatite, nephelite, wurtzite, zincite, and cerium oxide were used as nuclei. Part II. A project of Zworykin and von Neumann for forecasting by use of electronic calculating machines is discussed. *Subject Headings:* **Cloud seeding, Weather forecasting.**—*M.R.*

C–131 551.509.67(94)

Kraus, E. B., and Squires, P., **Experiments on the stimulation of clouds to produce rain.** Nature, [London], 159:489, **1947.** 6 figs., 3 refs. **DLC**—Report of dry ice seeding tests carried out in Australia. Radar observations made. Photographs taken. *Subject Headings:* **Cloud seeding, Australia.**

C–132 551.509.67

——— **Pluie artificielle déclenchée par la glace sèche.** [Artificial rain released by dry ice.] Sphere, 189(2463):68, April 19, **1947.** 2 photos. **DLC**—Photographic records of Australian and American dry ice seeding experiments with short explanatory note. *Subject Heading:* **Cloud seeding.**

C–133 551.509.67(795)

Richards, Leverett, G., **How to make it rain.** Country Gentleman, 117(8):15+, Aug. **1947.** 3 photos. **DLC**—Popular report of dry ice seeding experiments in Oregon. Schaefer's work also reviewed, and mention is made of Australian experiments. *Subject Heading:* **Cloud seeding.**

C–134 551.578.41:551.509.67

Schaefer, Vincent J., **Methods of dissipating clouds in the natural atmosphere.** Institute of Navigation, Journal, 1(7/8):172–174, Sept./Dec. **1947.** ref. **NSGE**—Production of snow from supercooled clouds in the natural atmosphere is discussed. *Subject Headings:* **Precipitation formation, Cloud seeding.**

C–135 551.509.67

Spencer, Steven M., **The man who can make it rain.** Saturday Evening Post, 220:24–25+, Oct. 25, **1947.** Popular account of Schaefer's and others' rainmaking tests, painting a bright picture of economic and meteorological possibilities of cloud seeding. *Subject Headings.* **Cloud seeding, Vincent J. Schaefer.**

C–136 551.574.1:551.509.67

Vonnegut, Bernard, **The nucleation of ice formation by silver iodide.** Journal of Applied Physics, 18(7):593–595, July **1947.** table, 2 refs. **DLC**—Pure silver iodide crystals, being similar in structure to ice crystals, are found to produce many thousands of times as many ice nuclei as impure silver iodide or lead iodide. Generator for producing silver iodide nuclei is described. Experiments are conducted. *Subject Heading:* **Cloud seeding.**—*M.R.*

1948

C–137 551.577.11:551.509.67

Bannon, J. K., **Rain making.** Weather, 3(9):261–266, Sept. **1948.** 2 plates, 11 refs. **DLC**—Discussion of Bergeron's theory of rain formation; artificial seeding of clouds; physical change in a seeded cloud; seeding at temperatures above freezing; Langmuir's breaking-drop theory; practical possibilities. *Subject Headings:* **Rain formation, Cloud seeding.**

C–138 551.509.67(71)

Bassett, Cyril, **Plan rainmaking research in Canada.** Canadian Aviation, 21(9):18–19, Sept. **1948.** illus. Part 2, *idem*, 21(10):35, Oct. **1948.** (unchecked.) **DLC**—Plans of National Research Council, Ottawa, to conduct cloud-modification investigations are outlined. *Subject Headings:* **Cloud seeding, Canada.**

C–139 551.509.67(71)

Canada, Meteorological Div., **Statement of present status and practical applications of artificial inducement of precipitation from clouds.** Also: **Statement on investigation of artificial precipitation in Canada.** Canada, Department of Transport, Meteorological Division, CIR–1470, TEC–47. Toronto, July **1948.** 4 p. **DWB**—*Subject Headings:* **Cloud seeding, Laws, Canada.**

C–140 551.509.67

†*Coons, R. D., Gentry, R. C., and Gunn, Ross, **First partial report on the artificial production of precipitation. Stratiform clouds—Ohio, 1948.** United States Weather Bureau, Research Paper No. 30, Aug. **1948.** 63 p., 52 figs., 2 tables, 22 refs. **DWB**—Preliminary report of results of the Cloud Physics Project carried on jointly by U. S. Air Force, National Advisory Committee for Aeronautics and U. S. Weather Bureau. The objective is to determine in definite quantitative terms the practical limits and general utility of cloud modification processes in producing or suppressing precipitation and increasing visibility for aircraft. Experiments are described in detail, and data, tabulated. Results suggest that modification of supercooled clouds by artificially produced ice crystals does not normally result in precipitation of economic importance. (A summary report of this work appears in American Meteorological Society, Bulletin, 29(5):266–269, May **1948.** 2 tables, 4 refs. **DWB**—). *Subject Heading:* **Cloud seeding.**—*M.R.*

C–141 551.509.67

Drake, Lawrence, **Rainmakers are all wet.** '48. The Magazine of the Year, 2(3):61–70, March **1948.** 2 figs. **DLC**—(Abstract in Meteorological Abstracts, 1–108, Jan. 1950.)

Discussion of attempts to produce artificial rain by seeding clouds with dry ice. Author quotes authorities to refute optimistic claims made by journalists regarding such experiments. *Subject Heading:* **Cloud seeding.**—*M.R.*

**C–142** 551.509.67

Durst, C. S., Assembly of the U.G.G.I. at Oslo, Aug. 1948. Discussion. Meteorological Magazine, [London], 77(918):266, Dec. **1948. MH**—One paragraph summary of rainmaking discussions at the U.G.G.I. Assembly at Oslo; papers by Reichelderfer, Bergeron, Pawsey, noted. *Subject Headings:* **Artificial precipitation, Cloud seeding.**

**C–143** 551.509.67(44)

Eyraud, René, **Sur quelques experiences de pluie artificielle.** [On some artificial rain experiments.] Académie des Sciences, Paris, Comptes Rendus, 226:829–831, March **1948.** Results of artificial rain making attempts in France 1947 to 1948. Precipitation occurred several times, but only when temperature at the summit of clouds was well below 0°C. No quantitative check was made on amount of precipitation that reached the ground. *Subject Headings:* **Cloud seeding, France.**

**C–144** 551.510.42:551.574.1

Falconer, Raymond E., and Vonnegut, Bernard, **Smoke from smelting operations as a possible source of silver iodide nuclei.** General Electric Research Laboratory, Schenectady, Occasional Report No. 4, Project Cirrus, July 15, **1948.** 4 p., 2 figs., 4 refs. **DWB**—Possible sources of silver iodide nuclei and precipitation records are compared. No connection is found. *Subject Headings:* **Atmospheric pollution, Precipitation formation.**

**C–145** 551.509.67

Farwell, Charles A., **Past experiments and future prospects of artificial rainmaking.** Sugar Bulletin, New Orleans, 27(2):24–26, **1948. DA**—(Title unchecked.) From tests with dry ice-seeding of rain clouds in Louisiana it was concluded that "under proper conditions, the production of rain by the dry ice method can become a routine procedure. Our biggest problem now is with proper cloud conditions to be able to drop the rain where we want it, and when we want it." *Subject Heading:* **Cloud seeding.**

**C–146** 551.574.1:551.509.67

Howell, Wallace E., **Experiments in the nucleation of clouds with dry ice.** U. S. Air Force, Air Materiel Command. Technical Report No. 5676, p. 352–383, June **1948.** 12 figs., table. **MH-BH**—Experiments in releasing dry ice into clouds by various means and under various weather conditions. *Subject Heading:* **Cloud seeding.**

**C–147** 551.509.67(68)

King, J. et al, **Artificial stimulation of rain.** Nature, [London], 162:921, Dec. 11, **1948.** table. **DLC**—Letter to the Editor: Report of experiments of the South African Council for Scientific and Industrial Research to examine practical possibilities of artificial stimulation of precipitation. Experiments using dry ice noted. *Subject Headings:* **Cloud seeding, South Africa.**

**C–148** 551.576.11:551.509.67

Langmuir, Irving, **The growth of particles in smokes and clouds and the production of snow from supercooled clouds.** American Philosophical Society, Proceedings, 92(3):167–185, **1948.** 14 figs., 3 tables. **DLC**—This paper, delivered before the National Academy of Sciences, Nov. 17, 1947, gives a survey of: methods for generating smoke, later used in generating silver iodide particles; airplane static and icing conditions; theory of formation of ice and snow particles from supercooled water droplets, Mount Washington observations; development of Schaefer's dry ice experiments; theories of ice crystal nuclei; cloud seedings; chain reactions of snow flakes; growth of particles in clouds; water seeding theory; hurricane studies. *Subject Headings:* **Precipitation formation, Cloud seeding.**

C–149 551.578.1:551.509.6

†*Langmuir, Irving, **Production of rain by a chain reaction in cumulus clouds at temperatures above freezing.** Journal of Meteorology, 5:175–192, Oct. **1948.** 12 tables, 12 refs., 4 equations. **DWB**—Also: General Electric Research Laboratory, Schenectady, Occasional Report No. 1, Project Cirrus, April 15, **1948.** 26 p. **DWB**—Theory of cloud droplet growth. Processes in formation of rain. Accretion theory of growth of raindrops. Hawaiian seeding experiments above 0°C. *Subject Headings:* **Rain formation, Cloud seeding.**

C–150 551.509.67(969)

Leopold, Luna B. and Halstead, Maurice H., **First trials of the Schaefer-Langmuir dry-ice cloud seeding technique in Hawaii.** American Meteorological Society, Bulletin, 29(10):525–534, Dec. **1948.** 4 figs., 2 tables, 7 refs. **DWB**—Dry ice seedings were made to determine whether rain could be induced from cumulus clouds at temperatures above freezing. Precipitation resulted in some cases. Cloud thickness was considered a significant factor. *Subject Headings:* **Cloud seeding, Hawaii.**

C–151 551.576.11:551.509.6

†Ludlam, F. H., **The forms of ice clouds.** Royal Meteorological Society, Quarterly Journal, 74:39–56, **1948.** 8 figs., 4 plates, 25 refs. **DWB**—It is suggested from observation that ice clouds arise at saturation with respect to water and at supersaturation with respect to ice, which in combination with a sparsity of effective nuclei leads to rapid growth and high falling speed of the few ice particles. Summary is given of recent theoretical and experimental work. Discussion of fibrous structures of ice-clouds and how processes of decay and formation of clouds come about. Possible practical applications are suggested for dispersing natural clouds and producing rain by artificial ice nuclei. *Subject Headings:* **Cloud formation, Cloud seeding.**

C–152 551.578.1:551.509.6

——— Meteorological Office discussion of Langmuir's paper, "Production of rain by chain reaction in cumulus clouds at temperatures above freezing." Meteorological Magazine [London], 77(918):278–280, **1948. DWB**—Langmuir's paper was presented and reviewed by Ronald Frith and discussed pro and con by British meteorologists: Johnson, Absalom, Ludlam, Scrase, and Sutcliffe. *Subject Headings:* **Cloud seeding, Rain formation.**

C–153 551.509.65

Pauthenier, Marcel, **Sur la coalescence électrique des brouillards et éventeullement de nuages à température quelconque au moyen d'aerosols électrisés.** [On electrical coalescence of fog and eventually of clouds at any temperature by means of electrified aerosols.] Académie des Sciences, Paris, Comptes Rendus, 226(7):587–589, Feb. **1948.** fig., refs. **DLC**—Chart shows time-rate of coalescence of fog under simulated natural conditions as determined from the visibility, the effect of introduction of non-electrified drops (negligible), and the appreciable effect of introduction of electrified drops. *Subject Heading:* **Fog dissipation.**—*M.R.*

C–154 551.509.6

Pettit, K. G. and Orr, J. L., **Suggested procedure for inducing precipitation from cloud.** National Research Council of Canada, Division of Mechanical Engineering, Low Temperature Laboratory, Laboratory Note Lt–6–48. Ottawa, July **1948.** 6 p. (Unchecked.) *Subject Heading:* **Cloud seeding.**

C–155 551.509.67

——— **Rainmaking and the law.** Canadian Aviation, 21(9):19, Sept. **1948. DLC**—Legal problems of rainmaking are briefly noted. *Subject Headings:* **Cloud seeding, Laws.**

C–156 551.509.67(772)

Renshaw, Bill, **Can we help it rain; it has been tried in prairie farmer land—with some success.** Prairie Farmer, May 8, **1948.** p. 1+. **NSGE**—Popular description of some cloud seeding experiments in Indiana. *Subject Headings:* **Cloud seeding, Indiana.**

C–157 551.509.67

*Roldán S., Ernesto, **Notas sobre lluvia artificial.** [Notes on artificial rain.] Boletin de la Sociedad Geografica de Lima, 65, 1948. 80 p., figs., photos, graphs, tables (extensive), refs. **NSGE**—Mostly description and discussion of work done in U. S. on cloud seeding. *Subject Heading:* **Cloud seeding.**

C–158 551.509.67

Roulleau, J., **La pluie artificielle.** [Artificial rain.] La Météorologie, 4e Series, No. 9:57–65, Jan./March, 1948. **DWB**—Discussion of precipitation formation theories. Brief report of attempts made in France 1947 by R. Eyraud. *Subject Headings:* **Cloud seeding, Precipitation formation.**

C–159 551.577.11:551.509.67(94)

Roy, A. K., **Rain-making experiments in Australia; experimental control on the yield of rain from clouds.** Science and Culture, 14(5):173–178, Nov. 1948. 8 figs., 3 tables. **DLC, NSGE**—General review of theories of cloud formation and artificial modification; discussion of Bergeron-Findeisen ice crystal theory of precipitation. Brief report on some of dry ice seeding done in Australia. *Subject Headings:* **Precipitation formation, Cloud seeding, Australia.**

C–160 551.509.67

Schaefer, Vincent J., **Experiments with cloudy skies.** Weatherwise, 1(1):3–5, 1948. illus. **DWB**—Author summarizes first year of activity in the field of cloud modification reviewing basic factors necessary for producing precipitation with dry ice. Partial list is given of experiments conducted in 1946, representative of general advance made in cloud modification. *Subject Heading:* **Cloud seeding.**

C–161 551.578.41:551.509.67

†Schaefer, Vincent J., **The natural and artificial formation of snow in the atmosphere.** American Geophysical Union, Transactions, 29(4):492–498, Aug. 1948. 4 figs., 19 refs. **DWB**—Author's abstract. Description given of experiments made in the laboratory and in the natural environment in which small quantities of dry ice have produced enormous quantities of snow from supercooled clouds. Dry ice or any other object colder than about −39°C. converts the supercooled water droplets into tiny ice crystals which grow, by vapor exchange, and become snow crystals. Conditions under which such action may be followed by precipitation are discussed. *Subject Headings:* **Precipitation formation, Cloud seeding.**

C–162 551.509.67:551.578.41

Schaefer, Vincent J., **The production of clouds containing supercooled water droplets or ice crystals under laboratory conditions.** American Meteorological Society, Bulletin, 29(4):175–182, April 1948. 7 figs., refs. **DWB**—Translated into Italian, **La produzione in laboratorio di nubi contenenti goccioline d'acqua soprafusa o cristalli di ghiaccio.** Rivista di Meteorologia Aeronautica, 9(1):38–45, Jan./March 1949. **MH-BH, DLC**—Detailed description of basic laboratory experiment in which a supercooled cloud may be seeded and converted into ice crystals. Transition temperature at which ice crystals form spontaneously is given as −39°C.+0.1°C. Technique for preserving snow crystal structure is described. *Subject Headings:* **Cloud seeding, Ice crystal formation.**

C–163 551.509.67

Schaefer, Vincent J., **The story of man-made weather.** American Fruit Grower, p. 17+, March 1948. **DA, NSGE**—Popular article on artificial cloud modification. *Subject Heading:* **Artificial precipitation.**

C–164 551.509.67:551.509.65(44)

†Schwob, Marcel, **La pluie artificielle et la dissipation locale des brouillards.** [Artificial rain and local fog dispersal.] Paris (O.N.E.R.A.) Publication No. 10, 1948. 24 p. (Unchecked in original.) Translation by D. A. Sinclair. National Research Council of Canada, Division of Mechanical Engineering, Technical translation No. TT-87, April 20, 1949. 30 p.,

41 figs., 21 refs. (list of refs.), 6 refs. (bibliography). **NSGE**—Review of physical phenomena and meteorological basis for modification of clouds. Appraisal of American research. Description of French contributions. *Subject Headings:* **Artificial precipitation, Cloud seeding, Fog dissipation, France.**

**C–165** 551.509.67(68)

South African Council for Scientific and Industrial Research, Pretoria, **Artificial stimulation of precipitation.** Interim progress report on experiments carried out by the Council for Scientific and Industrial Research, Division of Meteorology and the South African Air Force, Dec. 1947 to April 1948. Pretoria, **1948.** 20 p., 2 plates, charts, graphs, tables. **DWB**—The object and design, arrangements and equipment, of experiments in artificial stimulation of precipitation by cloud seeding in South Africa. Records kept. Conclusions drawn. *Subject Headings:* **Cloud seeding, South Africa.**

**C–166** 551.509.67

United States Congress, House. Committee on Interstate and Foreign Commerce. **Rainfall experiments.** Hearing, 80th Congress, second session on H. R. 4582; a bill to direct the chief of the U. S. Weather Bureau to conduct experiments with respect to methods of controlling rainfall. March 18, 1948. Washington, D. C. **1948.** 40 p. **DLC**—This report contains a broad survey of artificial precipitation research and problems, as well as the text of a bill, reports from govenment agencies, statements and letters from scientists involved in cloud physics research etc. *Subject Headings:* **Artificial precipitation, Cloud seeding, Laws.**

**C–167** 551.578.41:551.574.1:551.509.67

Vonnegut, Bernard, **I. Production of ice crystals by the adiabatic expansion of gas. II. Nucleation of supercooled waterclouds by silver iodide smokes. III. Influence of butyl alcohol on shape of snow crystals formed in the laboratory.** General Electric Research Laboratory, Schenectady, Occasional Report No. 5, Project Cirrus, July 15, **1948.** 12 p., 6 figs., refs., 9 equations. **MH-BH**—Measurements carried out on the nucleation of supercooled water clouds by silver iodide smokes. Found that silver iodide particles do not react immediately to form ice crystals when they are put into a supercooled cloud; crystals still form 50 minutes after silver iodide is introduced. Rate of reaction at −13°C. interpreted to be 30 or 40 times that at −10°C. *Subject Headings:* **Ice crystal formation, Cloud seeding.**

## 1949

**C–168** 551.577.11:551.509.67

†Bergeron, Tor, **The problem of artificial control of rainfall on the globe. 1. General effects of ice nuclei in clouds.** Tellus, 1(1):32–43, Feb. **1949.** 10 figs., 23 refs. **DWB**—From author's abstract: Different kinds and degrees of colloidal and thermodynamical instability of diverse systems of cloud-particles, partly leading to release of precipitation, are discussed, aiming at estimating the possible effect of seeding clouds artificially with ice-nuclei. Mechanics of producing stabilizing effects by over-seeding are discussed. *Subject Headings:* **Precipitation formation, Cloud seeding.**

**C–169** 551.509.67(48)

Bergeron, Tor, **The problem of artificial control of rainfall on the globe. II. The coastal orographic maxima of precipitation in autumn and winter.** Tellus, 1(3):15–32, Aug. **1949.** 10 figs., table, 10 refs. **DWB**—A scheme is presented to over-seed clouds in certain conditions along coasts of Sweden, Holland, and Norway, in order to stabilize them and prevent release of moisture until farther inland. *Subject Headings:* **Cloud seeding, Scandinavia.**

**C–170** 551.509.67(68)

B[annon], J. K., **South African rain-making experiments.** Weather, 4(5):155, **1949.** **DWB**—Brief report on dry ice and water seeding during the summer of 1947–1948. *Subject Headings:* **Cloud seeding, South Africa.**

C–171 551.509.67

*Coons, Richard D. Jones, Earl L., and Gunn, Ross, **Second partial report on the artificial production of precipitation; cumuliform clouds, Ohio, 1948.** U. S. Weather Bureau, Research Paper No. 31, Washington, D. C., Jan. 1949. 58 p., 28 figs., charts, 4 tables, 3 refs. **DWB**—Summary report of this paper in: American Meteorological Society, Bulletin, 29(10):544–546, Dec. 1948. 3 tables, 5 refs. **DWB**—Procedure of seeding and observations reported, including tables, adiabatic charts, radar scopes, photographs of clouds, etc. It was shown that artificial modification of cumuliform clouds is of doubtful economic importance in producing rain. Dissipation rather than new development was the general rule. Methods were not considered promising for relief of drought. *Subject Heading:* **Cloud seeding.**

C–172 551.509.67

Coons, Richard D., Jones, Earl L., and Gunn, Ross, **Third partial report on the artificial production of precipitation; orographic stratoform clouds—California, 1949.** U. S. Weather Bureau, Research Paper No. 33, 1949. 7 figs., table, 3 refs. **DWB**—This phase of the Cloud Physics Project concerns artificial modification of orographic type clouds and of clouds in different climatic areas. Complete description is given of each of the seedings and atmospheric soundings for each day. Results followed those of earlier missions. The natural water cloud dissipated in the immediate vicinity of the seeded area while the ice crystal structure of the seeded area remained little effected. Table indicates correlation between divergence field as calculated by Bellamy's method and the opening of holes in the cloud deck by seeding. Seeding is capable of dissipating clouds when horizontal divergence exists. *Subject Heading:* **Cloud seeding.**

C–173 551.509.67

Coons, Richard D., Jones, Earl L., and Gunn, Ross, **Fourth partial report on artificial production of precipitation: cumuliform clouds, Gulf States, 1949.** U. S. Weather Bureau Research Paper No. 33, p. 15–45, 1949. 28 figs., 2 tables, 2 refs. **DWB**—Summary report of this paper in American Meteorological Society, Bulletin, 30(8):289–292, Oct. 1949. 3 tables, 4 refs. **DWB**—Further tests in producing artificial precipitation from cumulus clouds were conducted near Mobile, Alabama, as a continuation of those of the Cloud Physics Project. Results were tabulated. It was concluded that rain did result from seeding operations, but not in excess of 0.2 inches, and that seeding, by usually stopping the development of cumulus clouds soon after they reached the freezing level, possibly interfered with the growth of some of them to full scale thunderstorms. Seeding inhibited growth of cumulus clouds by initiating premature downdrafts of ice crystals which subsequently choked off the necessary moisture inflow at lower altitudes and at lesser stages of development than those decreed by nature. *Subject Heading:* **Cloud seeding.**

C–174 551.509.67

Cunningham, Robert, Paper presented at the American Meteorological Society Meeting, Jan. 1949. photos. (Unpublished. Available through author, Massachusetts Institute of Technology, Cambridge, Massachusetts.) A dry ice seeding flight is described in which hexagonal and triangular replicas of resulting snow precipitation were taken below the seeded areas. *Subject Heading*: **Cloud seeding.**

C–175 551.574.1:551.509.67(931)

Cwilong, B. M., **Sublimation in outdoor air and seeded sublimation.** Nature, [London], 163:727–728, May 7, 1949. 4 refs. **DLC**—Tendency of silver iodide to initiate the sublimation of water vapor was tested in an expansion chamber. *Subject Headings:* **Cloud seeding, Sublimation nuclei.**

C–176 551.509.67

*Fraser, D., **Induced precipitation—preliminary experiments on seeding a variety of clouds with dry ice.** Report, National Research Council of Canada, Ottawa. National Research Laboratories, Division of Mechanical Engineering, Flight Research Section. Report No. MR–4, Jan. 18, 1949. 14 p., 5 figs., 2 tables. **DWB**—(Brief note of this work in Nature,

[London], 164:179, July 1949.) From author's summary: A number of dry ice seeding run were made above and below freezing level, over cumulus- and stratus-type clouds and in clea air. It appeared that precipitation could be produced from clouds if part of the cloud wa supercooled; cloud modification of an unpredictable type could be produced; under some condi tions clouds could be generated in clear air. Photographs were taken at time of seeding and afterwards. *Subject Heading:* **Cloud seeding.**

**C–177** 551.509.67(71

Fraser, D., **Production of ice-crystal clouds by seeding.** Nature, [London], 164:179–180 July 30, 1949. 2 refs. **DWB**—Letter to the Editors: Air supersaturated with respect to ice but not as to water was seeded with dry ice in some Canadian experiments. Photographs taken have allowed preliminary studies of the growth of generated crystals and comparison with crystals in adjacent natural clouds. Preliminary tests on rate of seeding, size of granules and other variables were made. *Subject Heading:* **Cloud seeding.**

**C–178** 551.509.67

Garrigue, H., **Sur le déclenchement artificiel de la pluie.** [The artificial release of rain.] Académie des Sciences, Paris, Comptes Rendus, 228(21):1658–1659, 1949. 2 refs. **DLC**—Influence of turbulence on the agglutination of fog is considered. *Subject Headings:* **Cloud seeding, Turbulence, Fog.**

**C–179** 551.509.67(7282)

——— **Honduras, Rustlers in the sky.** Time, 54(7):27, Aug. 15, **1949. DLC**—Brief popular article describing successful dry ice seeding for rainmaking by the United Fruit Co. over Sula Valley, Honduras. *Subject Headings:* **Cloud seeding, Honduras.**

**C–180** 551.509.67(791)

Krick, Irving P., **Evaluation of cloud seeding operations in the Phoenix area during the winter and spring of 1949.** Prepared for the Arizona Weather Research Foundation. Sept. **1949.** 80 p., 23 figs., 18 tables, 4 refs. Mimeographed. **NSGE**—Report covers aerial and ground cloud seeding operations. Each aerial seeding day is described in detail with flight times and paths. General weather situation is given and resultant precipitation pattern for each day. Development and use of ground seeding equipment, location of field units, and details of daily operations, are included. Means are described for determining the effects of seeding operations. All evaluations of seeding operations, aerial and ground, appear to be positive. *Subject Headings:* **Cloud seeding, Arizona.**

**C–181** 551.509.67:551.578.41

*Langmuir, Irving, **Study of the effects produced by the dry ice seeding of stratus clouds.** General Electric Research Laboratory, Schenectady, Occasional Report No. 10, Project Cirrus, Feb. **1949.** (Published in Final Report, Project Cirrus, Dec. 31, **1948.** p. 121–135.) fig., 8 photos, 4 tables, 24 equations. **MH-BH**—A dry ice cloud seeding flight is described. Information on the rate of propagation of the ice crystal cloud is correlated with meteorological conditions at the time. Effects produced on temperature and turbulence with a stratus cloud by seeding are considered, as well as rate of growth of snow crystals in air saturated with respect to water. Propagation of ice nuclei in stratus clouds and the effect of stability in cloud layers are discussed. *Subject Headings:* **Cloud seeding, Ice crystal formation.**

**C–182** 551.509.67

Lászlo, Aujeszky, A mesterséges esökeltés kerdésének mai állása. [The problem of artificial rain stimulation.] Idöjárás, 53(3–4):89–98, March–April **1949.** 11 refs. **DWB**—An analysis of known experiments and likely prospects of artificial rain production. *Subject Heading:* **Cloud seeding.**

**C–183** 551.509.67(71)

Perrie, D. W., **Cloud seeding experiments, November 1948.** Hydroelectric Power Commission of Ontario and Meteorological Division, Department of Transport. Toronto Meteorological Division Circular, 1554, **1949.** 12 p., tables and summary of induced precipita-

tion. **DWB**—Results of a series of cloud-seedings near Abitibi Lake, Canada. Procedures described, records kept. Use of seeding for dissipation considered more significant than for precipitation. *Subject Headings:* **Cloud seeding, Canada.**

**C–184** 551.509.67

†Perrie, D. W., **Precipitation release.** Toronto, Meteorological Division, Circular 1557, Jan. 1949. table, 11 refs. **DWB**—Paper read at Canadian Association of Physicists, Ottawa, May 1948, as part of a symposium on cloud physics. A summary of theoretical background and discussion of theories of artificial precipitation are given. *Subject Headings:* **Cloud seeding, Precipitation formation.**

**C–185** 551.576:551.574.1:551.509.67

†Schaefer, Vincent J., **The economic aspects of experimental meteorology.** United Nations Scientific Conference on the Conservation and Utilization of Resources, Lake Success, New York, Introductory paper prepared for Section Meeting: Water 1(C) on research in artificial precipitation, Aug. 22, 1949. 45 p., 25 figs., 29 refs., (restricted). **NSGE**—(To be published in a forthcoming issue of the new Swiss periodical, Zeitschrift für angewandten Mathematik und Physik, 1950.) Author discusses role of clouds in the hydrologic cycle; cloud types; amount of condensed water in clouds; degree of turbulence in clouds; types of nuclei in atmosphere; condensation, sublimation and freezing nuclei; causes of natural precipitation; man's efforts to produce rain; experiments in cloud physics; Project Cirrus and experimental meteorology; types of cloud seedings used; dry ice, water; kind of modification that occurs in numerous types of clouds. *Subject Headings:* **Cloud seeding, Cloud physics, Sublimation nuclei, Hydrologic cycle.**

**C–186** 551.509.67(78)

Schaefer, Vincent J., **The possibilities of modifying lightning storms in the Northern Rockies.** U. S. Forest Service, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana. Station Paper No. 19, Jan. 1949. 18 p., 5 refs. **DWB**—Also General Electric Research Laboratory, Schenectady, Occasional Report No. 11, Project Cirrus, Feb. 1949. **DWB**—(Abstract in Meteorological Abstracts, Jan. 1950, 1–110.) *Subject Headings:* **Cloud seeding, Thunderstorms.**

**C–187** 551.577.11:551.509.67

Schaefer, Vincent J., **Quarterly progress reports,** (Numbers 2 to 8), General Electric Research Laboratory, Schenectady, Project Cirrus, Nov. 1947 to June 1949. **DWB**—These reports are quarterly summaries of Project Cirrus research, giving accounts of personnel active in the program, status of instrumentation, research projects, flight operations, field projects. A list of Occasional Reports issued under Project Cirrus appears in Quarterly Progress Report No. 6. *Subject Headings:* **Cloud physics, Cloud seeding.**

**C–188** 551.576.11:551.509.67(7295)

Schaefer, Vincent J., **Report on cloud studies in Puerto Rico.** General Electric Research Laboratory, Schenectady, Occasional Report No. 12, Project Cirrus, April 1949. 16 p. **MH-BH**—The purpose of this operation was to determine type and physical characteristic of clouds that occur in Puerto Rico during winter months, and to develop and, if possible, to evaluate water seeding techniques. Operations are described. One of the results was development of a technique for sampling rain in and under a cloud. *Subject Headings:* **Cloud seeding, Cloud structure, Puerto Rico.**

**C–189** 551.509.67

Smith, E. J., **Experiments in seeding cumuliform cloud layers with dry ice.** Australian Journal of Scientific Research, Ser. A., Physical Sciences, 2(1):78–91, March 1949. 7 figs., 14 plates, table, 4 refs. **DLC**—From author's summary: Five experiments are described in which dry ice was dropped into supercooled cumulus clouds. Precipitation of snow or ice crystals occurred, and part or all of the cloud dispersed. Displays of haloes and similar phenomena were observed. Article contains adiabatic charts, data for different soundings, photographs of clouds during seeding experiments. *Subject Headings:* **Cloud seeding, Australia.**

C–190 551.509.67(94

Squires, P., and Smith, E. J., **The artificial stimulation of precipitation by means of dry ice** Australian Journal of Scientific Research, Ser. A., Physical Sciences, 2(2):232–245, June 194 2 figs., 2 tables, 6 refs. **DLC**—Dry ice seeding experiments near Sydney in supercooled cloud are described. Genuine positive effects are observed. Observations are consistent with th view that the precipitation grew from ice crystals (formed by dry ice pellets), in accordanc with theory of Bergeron. *Subject Headings:* **Cloud seeding, Australia.**

C–191 551.509.67:551.515.

——— **Thunderstorm control in U. S. A.** Weather, 4(5):152–153, **1949. DWB**—Shor item on Schaefer's theory to reduce or inhibit thunderstorm activity by seeding with dry ice *Subject Headings:* **Cloud seeding, Thunderstorms.**

C–192 551.574.1:551.509.6

Vonnegut, Bernard, **Nucleation of supercooled water clouds by silver iodide smokes** Chemical Reviews, 44(2):277–289, April **1949.** 6 figs., 5 refs., 9 equations. **DLC**—Measure ments carried out in a cold box on the nucleation of ice formation in supercooled clouds b silver iodide smoke particles show that ice crystals do not form immediately on these particles Silver iodide can be regarded as greatly increasing the probability of ice crystal formation. Th number of effective ice nuclei which can be produced per gram of silver iodide varies wit temperature. *Subject Headings:* **Cloud seeding, Sublimation nuclei.**

C–193 551.509.6

Vonnegut, Bernard, **Silver iodide smoke.** General Electric Research Laboratory Schenectady, Occasional Report No. 13, Project Cirrus, July 1, **1949.** 29 p., 19 figs., 8 refs **MH-BH**—Construction and operation of silver iodide smoke generators are described. Pre liminary experiments are conducted in seeding natural clouds with silver iodide. Most o them were inconclusive, but one time about 6 square miles of supercooled cloud layer wer transformed into ice crystals as the result of seeding with less than an ounce of silver iodide Photographs made. *Subject Heading:* **Cloud seeding.**

C–194 551.509.6

Ward, Chester, **Weather or not—the Navy may pay for rain.** JAG, Journal of the Judg Advocate General of the Navy, p. 2–8, Oct. **1949. NSGE**—Legal problems of rainmaking ar discussed. *Subject Headings:* **Artificial precipitation, Laws.**

C–195 551.509.6

——— **Would curb rain-makers.** Science Digest, 25(5):93, May **1949. DLC**—Brie article describing article in Yale Law Journal proposing a law to prevent irresponsible rain making. *Subject Headings:* **Artificial precipitation, Laws.**

1950

C–196 551.509.6

Frith, Ronald, **Artificial nucleation of clouds.** Meteorological Magazine, [London] 79:5–9, Jan. **1950.** Also: . . . Artificial stimulation of rain. idem., 79:9–10, **1950.** 8 photos **DWB**—Summarizes physics of seeding clouds by dry ice pellets to produce or control rain prevent hail or thunder, or clear cloud. Results of four trials in England are discussed, also an attempt to end drought in Teesdale. Some slight effects recorded. *Subject Headings* **Cloud seeding, England.**—*C.E.P.B.*

C–197 551.509.67

Kaempffert, Waldemar, **Rain made by cloud-seeding might possibly relieve New York City's water scarcity.** Science in Review. New York Times, Sunday, Jan. 29, **1950.** p. E9 Irving Langmuir's report on General Electric's cloud seeding experiments is reviewed Theories of rain formation are described. Practical application is considered. *Subject Head ing:* **Cloud seeding.**

C–198 551.509.67

Langmuir, Irving, **The control of precipitation from cumulus clouds by employment of various seeding techniques.** Paper read at the 105th National Meeting, American Meteorological Society Joint Sessions with the Institute of the Aeronautical Sciences, New York, Jan. 25, 1950. *Subject Heading:* **Cloud seeding.**

C–199 551.509.67

——— **Rain making debated.** Science News Letter, 57(4):61, Jan. 28, **1950.** The practicality of rainmaking is reviewed with respect to the proposed $50,000,000 appropriation that Congress is considering for research on rainmaking. Schaefer's and Wexler's opinions are expressed. *Subject Heading:* **Artificial precipitation.**

C–200 551.509.67(789)

Schaefer, Vincent J., **The effects produced by dry ice seeding of cumulus clouds in New Mexico.** Paper read at the American Meteorological Society, 30th Anniversary Meeting, St. Louis, Jan. 3–6, **1950.** Advance abstract in program of meeting. This paper describes in some detail one of a series of seeding experiments conducted during July 1949, near Albuquerque, New Mexico, as a field operation of Project Cirrus. *Subject Headings:* **Cloud seeding, New Mexico.**

C–201 551.509.67(789)

——— **Solution to water shortage; rain makers' success shows how New York could fill its reservoirs.** Life, 28(8):113–116, 119, Feb. 20, **1950.** Photos. Popular account of silver iodide seeding tests in New Mexico, summer of 1949. Silver iodide released from ground caused a small cloud which had given no radar echo of rain to grow into "heaviest man-made rainstorm." *Subject Headings:* **Cloud seeding, New Mexico.**

C–202 551.574.1:551.509.67

Vonnegut, Bernard, **Experiments with silver iodide smoke in the natural atmosphere.** Paper read at the American Meteorological Society, 30th Anniversary Meeting, St. Louis, Jan. 3–6, **1950.** Advance abstract in program of meeting. Generators have been devised to produce large numbers of silver iodide smoke particles for nucleating natural clouds, and successful experiments have been carried out in the modification of natural supercooled clouds by their use. *Subject Headings:* **Cloud seeding, Sublimation nuclei.**

C–203 551.509.67(04)

Walker, C. Lester, **The man who makes weather.** Harper's Magazine, 200(1196):63–70, Jan. 1950. **DLC**—Popular article about Vincent Schaefer's life and work with General Electric, especially his snowflake replicas and cloud seeding experiments. Seeding with dry ice, water, and silver iodide discussed. *Subject Headings:* **Cloud seeding, Vincent J. Schaefer.**

C–204 551.509.67

*Orr, John L., Fraser, D., and Pettit, K. G., **Canadian experiments on artificially inducing precipitation.** American Meteorological Society, Bulletin, 31(2):56–59, Feb. **1950.** 8 tables, ref. **DWB, MH-BH**—Analysis of results obtained from 57 cloud-seeding tests made with dry ice in Ontario and Alberta. A high percentage of success (clouds either modified or precipitation observed within 20 minutes) was obtained, especially from cumulus clouds with supercooled tops (81%). Even stratus clouds gave 69% success when tops were supercooled, but a low percentage (12%) of cases of precipitation reaching the ground. No evidence of self-propagating storms was found, and no appreciable economic importance could be attached to results, even though they were spectacular from a scientific point of view. A systematic tabular presentation of results is given (number of cases and percentages) for the following categories: cloud type, height, thickness and temperature, type of precipitation (virga, or reaching ground), clouds modified (developed or dissipated), and whether precipitation occurred within 25 miles. *Subject Headings:* **Cloud seeding, Canada.**—*M.R.*

# PART III. METEOROLOGICAL ARTICLES APPEARING IN RECENTLY ISSUED PUBLICATIONS

**Akademiia Nauk, SSSR, Izvestiia, Ser. Geogr. i Geofiz.,** v. 13, no. 4, July–Aug., 1949.

Obukhov, A. M.: **K voprosu o geostroficheskom vetre,** [On the question of geostrophic winds], p. 281–306.

Shtaude, N. M.: **Sumerechnyi metod issledovaniia stratosfery,** [Research on the stratosphere by means of twilight (observations)], p. 307–319.

Imianitov, I. M.: **Izmerenie gorizontal'noi sostabiiaiushchei elektricheskogo polia v atmosfere,** [Measurements of the horizontal electric field of the atmosphere], p. 320–330.

**American Geophysical Union, Transactions,** v. 30, no. 6, Dec. 1949.

Colson, DeVer: **Air flow over a mountain barrier,** p. 818–830.

Alldredge, L. R. and Dichtel, W. J.: **Interpretation of Bikini magnetic data,** p. 831–835.

Rumbaugh, L. H. and Alldredge, L. R.: **Airborne equipment for geomagnetic measurements,** p. 836–848.

Munk, W. H.: **Surf beats,** p. 849–854.

Powell, Ralph W.: **Resistance to flow in smooth channels,** p. 875–878.

Langbein, W. B.: **Annual floods and the partial-duration flood series,** p. 879–881.

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